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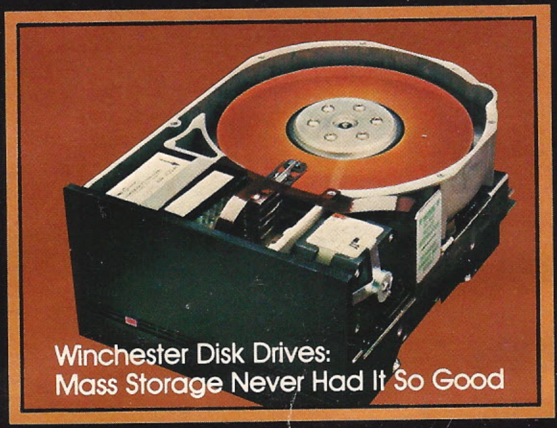

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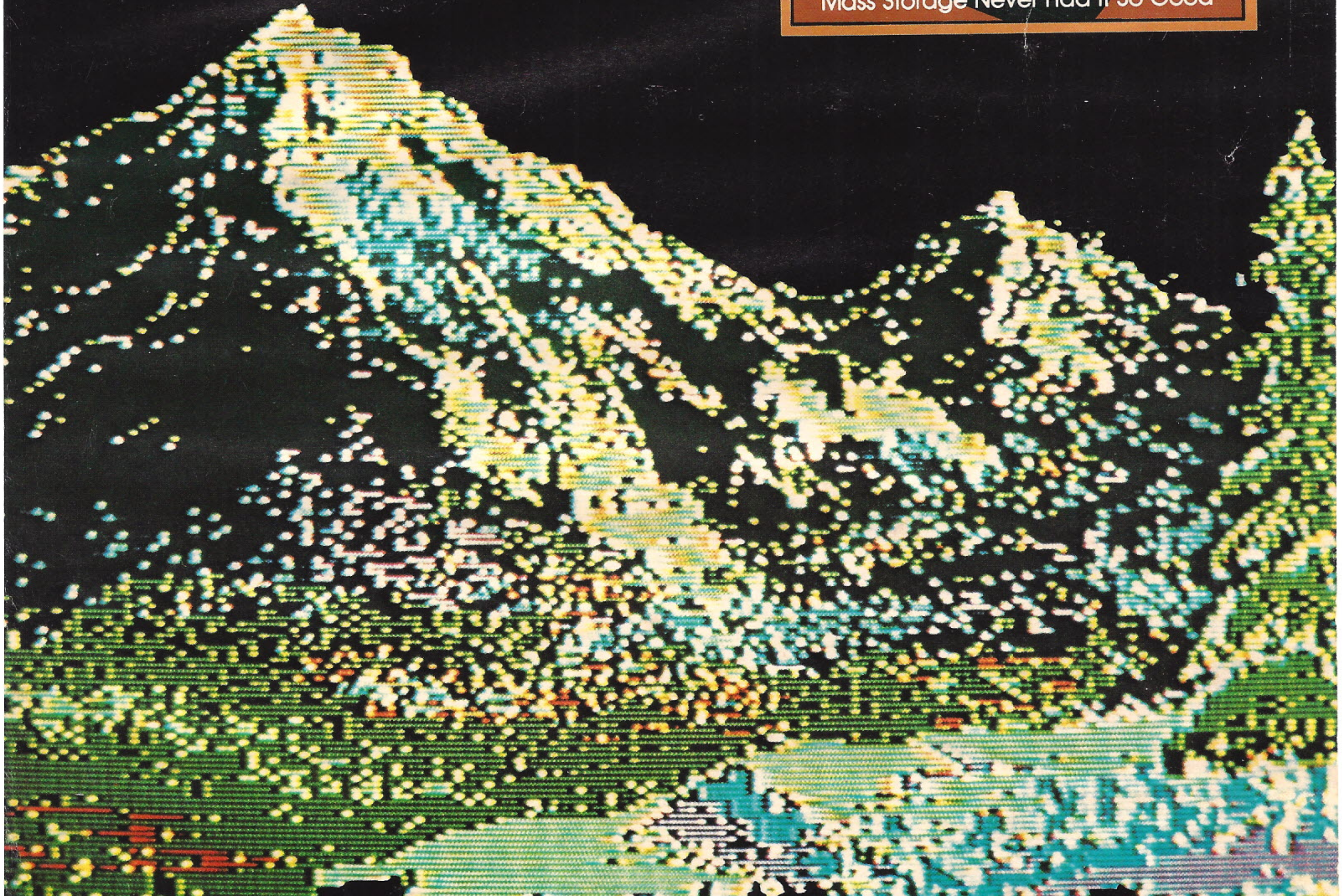

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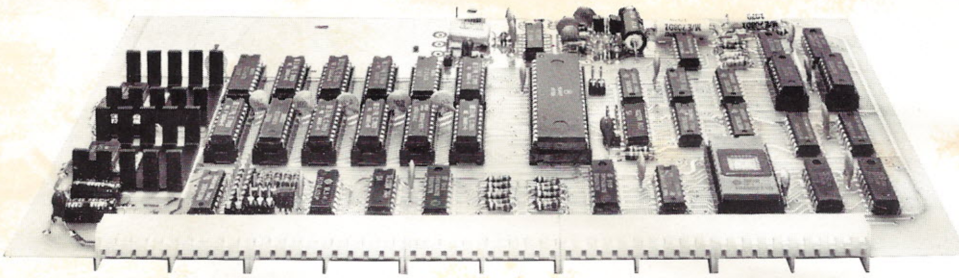

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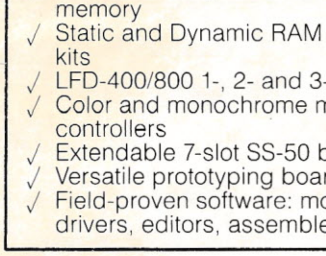

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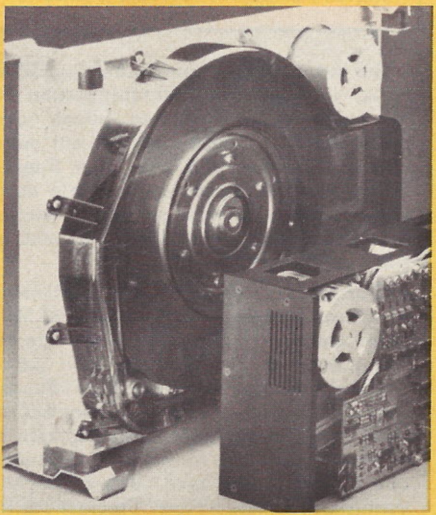

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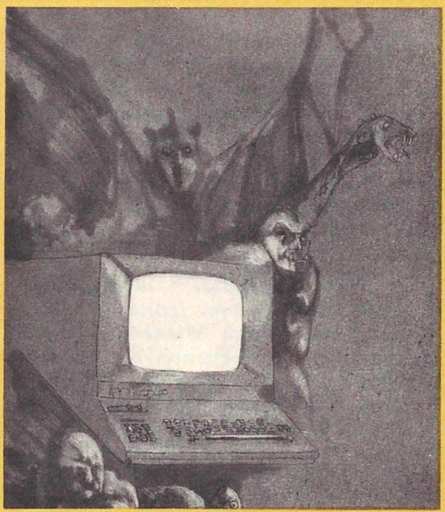

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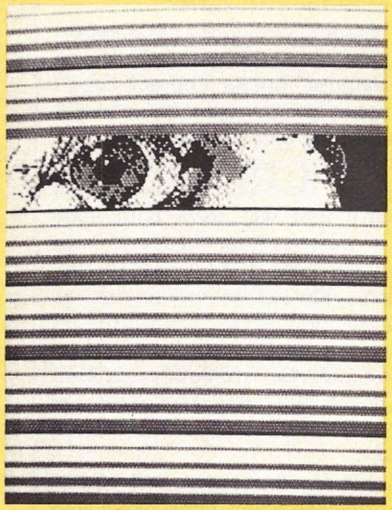

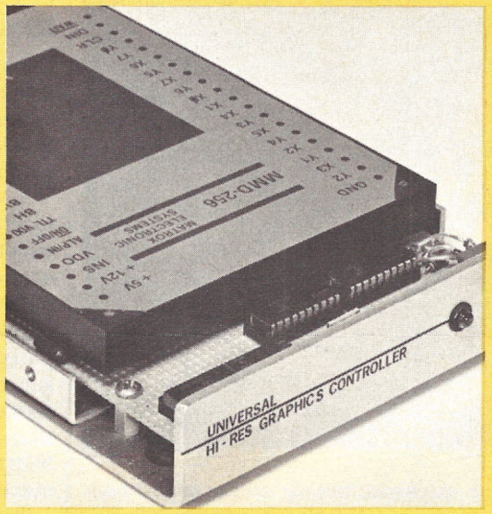

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This month:

If a picture is worth 1K words, then this month's issue of *Kilobaud Microcomputing* can be measured in megabytes.

Our exploration of the world of graphics begins with the results of our graphics contest (p. 84). Entries were submitted in one of four categories—black and white and color video, and printer and plotter hard copy—and the results show the complexity you can achieve with a little programming skill and creativity.

As the graphics articles in this issue point out, graphics are for more than just cartoon animation or for games; they can be used to display statistics, in plotting and as a convenient aid in scanning data.

It is anticipated that the computer graphics field will triple within the next four years, due, in large part, to the growing uses of graphics in business. As this field continues to expand, we'd like to see more articles about how micrographics are being used as business tools.

—The Editors

Next month:

Next month *Kilobaud Microcomputing* will take a look at the popular Apple II and the much-heralded Apple III computers. We'll examine some unique applications for the versatile Apple II and find out what delayed the widespread introduction of the Apple III.

This month's cover:

The first place prize winner in *Kilobaud Microcomputing*'s first annual graphics contest was entitled "Mountains," by Ben Lanterman (12162 Haldane Court, Bridgeton, MO 63044). Ben's color video composition was produced with VersaWriter on a 48K Apple II microcomputer.

Photo inset: Shugart Technology's ST500 series 5.25-inch disk drive system. (Photo courtesy Seagate Technology)

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By Wayne Green

That's Show Biz

Commodore Hops onto The Circuit

Commodore Shows

Commodore has been putting on a series of shows. But, unlike Radio Shack, they have allowed spaces for their supporting firms, not just their own products. Radio Shack seems to pay lip service to their supporting manufacturers and software firms, but when it comes to letting them in on the act, even marginally, no dice.

The accompanying photos show some of the highlights of a Commodore show I recently attended in Boston.

Since most of the advertising for the show was on local TV and in the newspapers, the turnout was mostly interested businessmen and their families, with only a few hobbyists. I went down to see how the show went—and also to give a couple of talks on microcomputers. The turnout for the talks was not impressive, but those who did come were seriously interested and asked excellent questions.

I had hoped to meet some of the Commodore corporate people who were there, but they were far too busy talking with each other to meet many of us visitors. I was quickly introduced to several of them by Mike Tomczyk, Commodore marketing strategist, but was unable to talk with them.

One of the big hits of the show—perhaps to the consternation of the PET and CBM contingents—was the new VIC-20. Here's Mike Tomczyk, center, the VIC-20 guru, explaining it to an amazed crowd.

The show was interesting, but many of us wondered if it was cost-effective. They sure spent a bundle for such a sparsely attended show.

Commodore recently moved into Boston for a weekend, taking up the grand ballroom at the Sheraton in the Prudential Center. Commodore did a good job of organizing the show, with big signs showing what each participating firm was doing.

IBM, Where *Are* You?

Every so often one of the trade papers prints a story about IBM and their "about to be introduced" microcomputer. I don't think anyone in the industry is really anxious for the other shoe to drop.

A recent story claimed that the IBM machine will be S-100 compatible, in which case IBM will have both gone against all precedent for them and have pulled off one of the best coups in the micro business. Most of the early microcomputers used the S-100 bus, with the result that an enormous number of accessories and gadgets were built up around that standard. With the push of George Morrow, the S-100 has become an IEEE standard.

The first major firm to jump off the bus was Commodore. Then came Heath, and

finally—as a capping blow—Radio Shack. As one after another of the S-100 firms mismanaged themselves into oblivion, only the seriously dedicated microcomputer enthusiast remained involved with the S-100. Apple, which avoided the S-100, was still small during the early micro period, but now is in second place in sales. No firm in the top ten today is using the S-100. This has managed to kill off about 90 percent of the firms which were building S-100 compatible boards.

The S-100, which was cooked up in a few minutes one day by Ed Roberts, the president of Mits, and producer of the first microcomputer, left a lot to be desired. The basic idea was good—to build the computer using a large enough bus structure so any type of board could be plugged in to expand the system. The IEEE committee and George Morrow have since developed the bus to the point where today it is probably the single most practical bus structure for a genuinely flexible computer system. With shielding and other special techniques, it is even possible to keep the noise radiation of the bus down to FCC-acceptable limits.

With an S-100 system you can expand the uses of a computer system just about as much as you want. The CPU is on one board, the display generator often on another, memories on further boards, interfaces on others, and so on. Thus a system can be used for business with word processing, color graphics, disk control, music generation, control purposes, and so on, without having to plug in outside boxes for each new application.

Obviously, thc cost of an S-100 system is going to be higher than the single board computers, but then IBM has never been a low-price outfit, and there is no reason to expect them to start now.

The Neeco exhibit was typical of the dealer support. Note the small kids, who were there in large numbers. They got a real kick out of the computers and picked up a lot of literature for their folks.

Programs

Most of the interest these days is in providing more business-oriented programs, for most of the popular systems. There is still an unlimited need for programs for publication by our magazines and books, as well as by Instant Software. Remember one thing—if your program runs in one of the magazines we *don't* publish, we can't consider it for Instant Software, and you *could* lose a fortune.

What programs are needed? Of particular interest are programs for helping specific types of businesses. For instance, small towns need a program to help them keep track of their voters, land owners, taxes, assessments and so on. Printers need programs to help them estimate print jobs. Virtually every type of business can be helped by specialized computer programs, which can then be sold by Instant Software.

General programs, such as inventory, are important, too. These come in a wide variety of shapes and sizes, each geared to special needs. Some of these variables can be handled in the initializing of the program if you build in the flexibility, while others will just have to be geared for certain applications. I suspect that we will end up with perhaps a dozen or two inventory programs that are stocked by stores, each with different ways of handling things. It is useful to remember to put routines in your programs that will enable data to be accessed by other programs when needed, such as for totaling inventory assets.

Games are not very important right now. Good adventure games are selling and will be considered for publication. Most computerized versions of board games have declined in sales. Utilities are good sellers, as are diagnostics.

Educational programs are getting started, but no one knows yet where they are going. It would seem reasonable that programs which can replace tutors would help sell systems. Many of these are drill programs in math, languages and so on. Educators with a programming bent might see what they can do.

If you're not into original programming, perhaps you'd like to try your hand at conversions. Programs for the TRS-80 can be converted to run on most other systems, though the graphics can be tricky at times. If you want to have at this, let us know what system you'd like to tackle. We have over 1000 programs accepted for publication, most of which can be made to run on at least a half-dozen popular systems. □

Sure, Instant Software had a booth. Reese Fowler, the head of software procurement for Instant Software, is answering questions, while Sherry, on the right, shows copies of Microcomputing.

By Robert W. Baker

8032 Data Handlers

Database Programs Reviewed

OZZ, the Information Wizard

OZZ is a general-purpose database program. Designed specifically for the 8032 CBM with an 8050 disk, it was written by the Bristol Software Factory and is being sold through Commodore. It's written entirely in machine language, and is thus very fast, though dependent on the CBM ROMs. It's not quite as powerful or flexible as Jinsam, but it does have several very nice features all its own.

OZZ requires a matched set of diskettes to maintain up to ten data files, depending on the size of the files. To conserve space, each data file only uses as much space as necessary and can be extended at any time. The maximum size of any one data file is 364K with a single 8050 disk unit (two diskettes). The maximum number of records within any one data file is 64,000 records. For each data file created, there's about a 68.8K overhead: 60K for a printed document format, 7.8K for a calculator program and 1K for file management.

One of the nicest features of OZZ is the way the data file format is defined. A special editor allows you to effectively draw a picture of how you want each data record to look. You simply define boxes to contain the information along with headings, titles, comments, etc. Each box also defines the data type (text or numeric) and the length of the field. For numeric fields you can even define the exact decimal position within the field. You have complete freedom in defining the format; everything is placed wherever desired on the CBM display. However, the maximum total length for all fields in the record cannot exceed 252.

The first text field defined within the record is always used as the key field. This is used whenever you want to access a particular record by name. This fact is very important and must be kept in mind when first creating a data file. The key field must be something that will be unique for every entry in the data file. Also, once entered, this field should not be changed at any time.

Once you've defined the file format, it can be saved on the disk as a named file. The name is then used to later reference a particular data file, and any subsequent commands will refer to that file until another is selected.

Adding or editing records is easy. The file format is displayed on the screen and the cursor appears in the first box. If you're editing a record, the existing data is also displayed within each field. All you do now is position the cursor and fill in or change the boxes. Normal, full-screen editing is provided so you can easily correct mistakes and make appropriate changes.

Several methods of retrieving information are provided to handle your varying demands. You can find records by the key field, asking for a record by its name. For convenience, you can use an asterisk (*) for abbreviated names with character matching. You can also specify a particular record number within the data file, or even perform a sequential search both forwards or backwards. More powerful searching allows you to specify particular pieces of information within a record you want to find.

> The current OZZ package from Commodore is a well-documented and very useful product.

Another powerful feature of OZZ is a built-in calculator. It lets you make calculations based on information in the data files. The calculator can be operated under direct control or can be programmed to perform a number of calculations successively. Numeric fields of the data records are referenced by their associated labels.

The calculator memory can contain an additional 16 newly defined working variables if required. The calculator is accurate to 14 significant places for addition, subtraction, multiplication, division and percentage calculations. The results of any calculation can be posted into the data record, displayed or saved on the calculator memory. When programming the calculator, up to 16 calculation steps can be entered in any one calculator program. For added convenience, calculator programs can be saved on disk as named files for later recall.

For printed output, OZZ has a document editor that's used to define how printed documents are to be generated and what they contain. This editor is much like the one used to define the data file format. It allows you to draw the layout of the document on the computer screen, defining fields, labels, headers, footers, etc. You can even insert breakpoints in the format that tell OZZ when to stop printing and get new information from the data file. As expected, the document formats can also be saved on disk as named files for later recall.

Combining the many features of OZZ, you can easily list a data file in a specific document format while performing calculations defined by a calculator program. Optionally the data records can also be updated. Another feature allows selectively listing a data file depending on an analysis mask. Any number of criteria can be set in the mask to list only the exact records desired.

There are several other functions provided that allow deleting records, printing whatever is currently displayed on the screen, or even verifying the database. You can also display a list of all data files, showing the record length and

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The Z89: a subcompact microcomputer that needs about as much space on a desk as a portable TV set.

And needs about as much technical training to operate. Because the Z89 uses the industry-standard CP/M ™ operating system, it accepts a vast variety of existing software. Most microcomputer programmers already know it, and anyone trained on larger systems adapts to CP/M* in a flash. The Z89 also uses standard, currently available software on both 5¼" and 8" floppy disks, yet is capable of more sophisticated operation using extended languages such as Microsoft BASIC, COBOL, FORTRAN, and PASCAL.

The keyboard follows the standard typewriter format, with every touch of a key confirmed by an audible click. Numbers are duplicated in calculator format, with up to 18 decimal-place accuracy. And the large-capacity non-glare video display is easy on the eyes.

The Z89 is a sub-compact desktop unit with a memory of up to 64K bytes of RAM—more than enough for word processing, accounts payable, accounts receivable, inventory control, and many other business, scientific, and technical applications . . . without a zillion different cords hanging out of the back.

And now, for you tech-spec freaks, some important jargon regarding standardization and flexibility:

Disk data: Choice of internal or external storage, or combination; 100K to 2.5 megabytes. 5¼" flexible drives (standard 10-sector hard-sector media, single-side single-density) for lowest media cost. 8" disk drives (double-side double-density) for greater storage; also standard IBM single-side single-density format for exchanging data with other computer systems. Available in either 48K or 64K systems.

Zenith is a boot-loaded RAM system, so it can accommodate the latest software on the market, and anything new that's likely to come along in the future. Twin serial input/output ports let you interface with just about any printer or modem on the market—handy whether you already have them now, or want to add them in the future. And with five different Zenith models, from a basic 48K no-disk-drive, to built-in 5¼" or 8" single or double disc drives, you can put together 18 different configurations . . . which means you can design a system to fit your exact job, rather than force your job to fit a system. In other words, the Z89's capabilities make the microcomputers with the cute names look like toys

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number of records in each data file.

The current OZZ package from Commodore is a well-documented and very useful product. However, it lacks several features that could make it much more powerful and certainly more flexible. The biggest problem is the lack of provisions for changing a record format. If you wanted to later change the format of a data file, you'd have to create an entirely new data file and reenter the entire database.

Also, there's no way to interface a data file with other programs like Word Pro or VisiCalc. In fact, there's no mention of the file formats in the documentation that would allow you to create your own interface. Lastly, there's no way to define additional sort keys or to extract a subportion of an existing data file.

Commodore has mentioned that future additions and enhancements are planned to correct some of these shortcomings. There may even be a few related utility programs provided, rather than incorporating a number of new features within OZZ itself. Even so, OZZ is still a very useful and potentially powerful program.

Create-A-Base

Create-A-Base is another high-quality, versatile database program, this one coming from Micro Computer Industries (1520 East Mulberry, Suite 170, Fort Collins, CO 80524). The program was designed to be simple and easy to use, and really lives up to this claim. The user is prompted through all functions with a friendly question and answer dialogue. Owners of older CBM/PET systems are out of luck, however, since Create-A-Base only works on the 8032 CBM with a 4040 or 8050 disk drive.

On the other hand, the program will operate correctly with a number of different printers: CBM, NEC Spinwriter, Tally 8024 or any ASCII printer. Math functions are also included so the program can be used to set up inventory, accounts receivable and other common bookkeeping operations.

The program comes with an extensive 65-page manual, divided into four basic sections. The first section gives basic information on preparing your system to use Create-A-Base. The second section contains simplified lessons to give the beginning user hands-on experience in using the many features provided. After working through the lessons you should have a very good idea of how to use the program for your particular applications. The third section gives a brief explanation of each command, including the special command functions. The last section is really an appendix, containing technical data, a list of two-letter state abbreviations and information in case you should run into difficulties with the program.

The Create-A-Base program modules are written in BASIC and require a special ROM installed in the usually empty UD12 socket of the 8032. This socket is the last empty socket toward the rear of the main logic board. The Word Pro 4 ROM normally goes in the UD11 socket just in front of UD12. Unfortunately, the UD12 socket is also used by the VisiCalc ROM. Complete instructions are included for installing the ROM; just follow normal precautions for handling MOS devices.

When first loaded, Create-A-Base lets you select whether or not you want sound, and the type of printer being used.

However, it does not let you specify the printer address in case it is not device #4 on the IEEE bus. The program then requests the data file name to be created or used. You can, if desired, enter a special command at this point to display the disk directory, sort a database or create a Word Pro formatted file. When a file name is specified, the main command selection menu is displayed and the program waits for further input.

When first creating a data file, you have a choice between two major structures. One allows up to 24 fields or 220 characters per record with 650 records maximum. The other allows up to 12 fields or 105 characters but 999 records maximum. Thus, you must choose between having maximum characters and minimum records, or minimum characters and maximum records. There is no in-between with Create-A-Base.

As with other database programs, Create-A-Base has many commands for adding, editing, listing or deleting records. You can also rename fields within records or even add new fields to existing data files. Other functions allow you to easily merge or transfer data files. A separate sort module allows sorting on any one field or a pair of fields. You can recall records by record number or a sort key field.

Output can be in a standard format or user-defined formats. A number of parameters are selectable to design the output however desired. The program can save up to nine different formats for each data file. You can even do calculations with totals, enter headings, print by a select code, format numbers as dollar and cents or integers, etc. For mailing labels there are three predefined formats in the most commonly used layouts.

Other special commands allow merging, transferring and scratching files. You can merge different data files or even transfer files from a 2040 disk to an 8050 or 4040 disk. There's even a method of reading sequential files to develop files that can be manipulated by Create-A-Base.

Other nice features include the ability to create input files for Word Pro 4 and being able to display the disk directories. The list of features and commands is rather extensive; you really have to play with the program to see all that it can do.

After trying Create-A-Base for a few weeks, I found it to be a very fine product and nicely documented. It provides a host of features, many of which can be very handy at times. The program is easy to use and data entry is very straightforward. Create-A-Base may not be quite as fast or powerful as Jinsam, but for small-scale users it just might be very attractive depending on your needs.

As more and more high-quality software packages such as Create-A-Base, OZZ and Jinsam become available, choosing what is best for a certain user with a particular application gets harder and harder. If at all possible, try to see a local dealer and experiment with various software packages before running out to buy. Many of the better-quality products are being displayed at the various Commodore shows across the country. Attending various computer shows also gives you an excellent opportunity to try different software packages, sometimes side by side for easy comparison.

A New Product For an Old PET

Optimized Data Systems has an adapter for the old style 8K PET that allows the use of industry standard 2114 1K-by-4 RAMs as a replacement for defective 22-pin 6550 memory chips. The 2114

memory chips are much less expensive and more readily available than the 6550, typically selling for as little as one third the cost of a 6550.

The PH-001 RAM adapter is a small, 4.25 by 2.7 inch, double-sided printed circuit board that normally plugs into the 6550 sockets on the PET main logic board. It provides space for up to eight 2114s (4K). If more than eight 6550s require replacement, a second adapter can be used. Even though the adapter uses two 6550 sockets for connection, both 6550 ICs can still be installed in sockets on the adapter. Therefore, the adapter can be installed prior to any 6550 failure and be ready for use when one does occur. For each 6550 failure, one 2114 is installed on the adapter. Low-power 2114s (2114L) with an access time of 450 ns or faster should be used.

Both the 2114 and 6550 are 1K by four-bit static NMOS memory devices. The primary differences between them are in pin configurations and the use of an internal 1K chip select decoder in the 6550. The PH-001 adapter board uses a 74LS139 dual decoder to provide the necessary 1K chip selects as well as a valid write strobe for all 2114s on the board. There is a one-to-one correspondence between 6550 address and data lines and those in the 2114s. Therefore, any memory diagnostic programs you use that refer to memory locations or bits will still correspond properly to the 2114 locations.

In addition to replacing defective 6550s, the PH-001 adapter can be used as a low-cost 4K byte memory expansion for the PET. This requires constructing a cable between the PH-001 wire-wrap sockets and the PET memory expansion connector. Directions are included in the user instructions supplied with the adapter board, telling how to make the proper connections. By merely plugging a second adapter into the first one, a total of 8K can be easily added. Another section of the user instructions even tells how the adapter can be used for screen RAM replacement if necessary. This also requires building a simple interface cable, for which instructions are given.

The PH-001 adapter board is available in several versions to suit your budget—bare board, complete parts kits, or fully assembled. Prices range between about $9 and $25, while postage and handling are extra. Overall, it's a nicely made, high-quality package that's priced just right.

For more information and latest pricing on the RAM adapter or various PET programs also available, write Optimized Data Systems, PO Box 595, Placentia, CA 92670.

Food for Thought

I've come up with a little programming idea in the last few weeks that I think has great potential. Unfortunately, I really haven't had time to explore it further, so I thought I'd at least briefly tell what I've been thinking about. Maybe someone out there can come up with a real-life use for this, or expand upon the original idea.

We all know the problems caused by the various ROM sets that may exist in any given PET/CBM system. The problems get even worse when writing assembly-language programs, since they tend to interface directly with the ROM routines or low memory pointers.

My idea is simple. Suppose you're writing an assembly-language program but you intend to use disk files, perform intricate calculations or do something that would normally be quite easy in BASIC. If you try to do this same function in assembly language, it could get complicated. If you decide to take advantage of the existing ROM routines, then you'd normally be locked to a particular ROM version. Any changes in the ROMs would require a reassembly, or at least a few patches to the original program. However, there may be an easy way to avoid all this.

Why not write your main program in assembly language as planned, but return to BASIC to do special functions? This is just the opposite of the common practice of using short assembly-language routines within a main BASIC program. You can use predetermined areas of memory to pass parameters between your main assembly-language program and your BASIC subroutines. One byte could be used to indicate a desired function to be performed, while additional pointers and counters could be used to pass strings or numeric values.

The whole thing works like this:

You change the top of memory pointer to reserve an area for the machine-language program while leaving sufficient memory for the simple BASIC program. The first line of the BASIC program is an SYS command that branches to the first instruction of the assembly-language program.

Now your assembly-language program executes and goes about its business until it needs a function from the BASIC subroutines. It first sets a flag byte to indicate the number of the function to be performed, then sets any parameters needed by the subroutine in predetermined areas of memory. The program then sets a continue address and returns to BASIC via a 6502 RTS instruction (op code $60).

The PET will now fetch the next BASIC statement after the SYS command that originally passed control to the assembly-language program. All the BASIC program has to do now is read the flag byte via a PEEK instruction and branch to the indicated subroutine based on the number read. This can easily be done with a simple ON X GOSUB 100,200,300, . . . statement.

The selected subroutine then gets the

required parameters from a known area of memory via PEEK statements. After completing the desired function the return parameters are placed back in memory with appropriate POKE statements. An additional status byte might be set to indicate successful completion or an error. The BASIC subroutine then returns to the next statement after the ON X GOSUB. . . statement.

Two PEEK commands get the desired continue address, and an SYS to that address returns to the calling assembly-language program. A GOTO statement should follow the last SYS command to take the BASIC program back to the PEEKs and ON X GOSUB . . . statements to repeat the whole process the next time a BASIC subroutine is called.

Therefore, the simple BASIC program might look like:

```
10 SYS(......)
20 X=PEEK(.....)
30 ON X GOSUB 100,200,300,...
40 X=PEEK(...)
50 X=X+(256*PEEK(...))
60 SYS(X) : GOTO 20

100 REM SUBROUTINE—FUNCTION #1
.
.
.
190 RETURN

200 REM SUBROUTINE—FUNCTION #2
.
.
.
290 RETURN
```

With this simple structure, you can easily perform a string of calculations, open or close a disk file, read or write data records or whatever else desired. You don't have to worry about what happens to the ROMs, since you're using the standard BASIC interface to the ROM routines.

Also, you don't have to be concerned with the pointers in low memory since BASIC takes care of them. However, you are losing some speed by relying on BASIC to do part of your work for you. On the other hand, if you don't quite understand how to do certain functions in assembly language, this method gives you an easier way to handle difficult problems.

Somehow this whole idea seems useful, but I haven't found a place to use it yet. If anyone comes up with additional ideas or a real-life application, I'd be more than happy to hear from you.

Miscellaneous

Commodore's newsletter is finally back in print, but under a new name. *Interface* will be published six times a year and should appear on a regular basis, since they now have a full-time editor. Subscriptions are $15 for six issues and inquiries should be addressed to: Commodore Business Machines, Inc., Attn: Editor, *Commodore Interface*, 681 Moore Road, King of Prussia, PA 19406.

Eastern House Software, authors of the MAE assembler, are now publishing their own *EHS Gazette*. It contains programming hints, updates and notes on their products, information on various new products, and, of course, advertising for items sold by EHS. Information contained in the *Gazette* can be copied and reproduced. The *EHS Gazette* is free to anyone sending an SASE with appropriate postage to: *EHS Gazette* c/o Eastern House Software, 3239 Linda Drive, Winston-Salem, NC 27106.

Philip Chao of Rochester, NY, is trying to organize a program exchange between various PET user groups. He has written most user groups explaining his ideas of creating a disk library for the PET. Any user group that contributes to the library will have access to anything currently in the library for simply the cost of disks and postage. To help keep the work load to a minimum, the disk library will only be available to user groups, and not to individuals. Also, only entire disks will be copied; individual programs will not be provided.

If your group is interested and hasn't been contacted, write Philip W. Chao, Strong Memorial Hospital, PO Box 387, Rochester, NY 14642. When submitting programs for the library, please keep in mind that you should include only original software generated by members of the group. Programs from magazine articles should not be included unless specifically stated that they are in the public domain. If you read the masthead in *Compute* magazine, you'll find that any program published remains the property of the original author. Besides, it makes sense not to submit magazine programs. If everyone submitted a copy of the same program, you'd only be wasting time and valuable disk space. If in doubt about the true origins of any program, don't distribute it.

For those that haven't heard, Commodore has a 64K memory expansion for the 8032 system. This gives you a 96K CBM system, but BASIC can still only use 32K. Details on the new expansion board haven't been released as yet but should be out by the time this appears.

For owners of all model CBMs, Spima Computer of West Germany is offering a line of 64K memory expansion units. From the photographs, it appears to be a nicely made separate box that sits next to the CBM with an interconnecting ribbon cable. Unfortunately, the information included was all in German. For more information you can write: Spima Computer GMBH, Turbinenstrasse 4, 6800 Mannheim 31, West Germany.□

Address correspondence to Robert W. Baker, 15 Windsor Drive, Atco, NJ 08004.


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There are two scenarios and five levels of difficulty…level five is almost impossible to win. There are usually no fixed playing times for Scenario 2; you play until you get the governor and escape or until you are killed. But you can even set a fixed playing time in Scenario 1.

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COMPUTER GAMES THINKERS PLAY

By Frank J. Derfler, Jr.

Novation Unveils New Modem Line

Apple-Cat II, Modem Terms Explained

This month I'm going to get into some modem terminology. You won't need this information often, but when you do, you might not find it anywhere else. I'll also take a look at an exciting new versatile product, the Novation Apple-Cat II.

Apple-Cat II

Novation has developed an LSI technology modem module which will become the basis of a whole new family of microcomputer modems. The first product to use this modem module is the Apple-Cat II. Novation carefully gives Apple computers the credit for the Apple name, but Apple shouldn't mind, because the Apple-Cat II gives the Apple II great new communications capabilities.

The Apple-Cat II modem has two strong points: flexibility and total package integration. The integrated system comes ready to plug in. It has all the needed cables and interfaces and a powerful smart terminal software package on disk.

The flexibility of the system is outstanding. It will not only provide full Bell 103 standard 300 baud capability, but it will also operate at 1200 baud using the Bell 202 transmission standard. (See the following information on modem terms.) It has an option that will allow the modem device to operate as a 45.5 baud, Murray/Baudot coded, Weitbrecht modem for the use of the deaf community. That feature means that a deaf user can use ASCII signals for access to information utilities such as The Source or CompuServe and still communicate with users of older TTY equipment. (The change of mode is not quick; it may require a ROM replacement.)

Telephone operations can be controlled from the keyboard or from software. The system will auto dial using either pulse or dual-tone dialing, will redial calls and will auto disconnect. The Apple-Cat II can be told to listen for a second dial tone before dialing additional numbers in case you are using a system where you have to reach an outside line. (Almost all other dialing modems simply wait a few seconds and assume they received the second dial tone. This can often be a false assumption.) An optional module provides jacks so you can attach a telephone handset (not provided) and have a complete integrated voice or data installation—you can even hang the handset on a special "cradle" on the side of the Apple II.

Another modem system option will decode the tones from push-button phones so you can command your system from long distance even without a terminal. Jacks are provided for control of a tape recorder motor by the modem and for audio output to the recorder. Finally, the software to integrate the Apple-Cat II with a BSR X-10 remote control transmitter is optionally available on ROM.

The combination of all of that software, tone decoding and remote controlling capability should challenge the imagination of any microcomputer user.

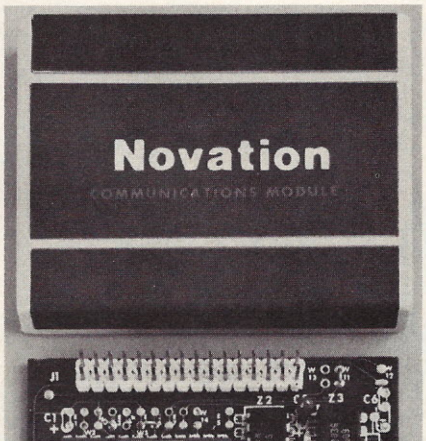
The communications software (dubbed Comm-Ware by Novation) provides many features. It will save data in files, transmit either binary or text files, and allow off-line message preparation. It will transmit word processor files if they are standard ASCII. The only soft spot in the software I found is that it will not do prompted transmission. Systems like the ABBS, PMS and CompuServe want the transmission software to send message inputs a line at a time. They want to prompt each line with a character, such as a greater-than sign or question mark.

The Comm-Ware program does provide for variable rate transmission. If you set this speed properly, you can match the prompt rate of most systems, but you usually transmit more slowly than you need to or miss an occasional character. This is particularly true when CompuServe's EMAIL sends a new top-of-page header. It expects you to wait when it does this. Aside from the lack of prompted transmission, the Comm-Ware program provides for a very intelligent terminal capability. (At publication time, Novation says they are upgrading the software for prompted transmission.)

Most terminal functions may be performed at 1200 baud using the Bell 202 signaling format, but a special Comm-Ware feature makes use of the 1200 baud mode to send files to another Apple-Cat II system. The system uses a unique protocol, but it does open great possibilities for the transfer of messages between message systems and between individual Apple-Cat II users.

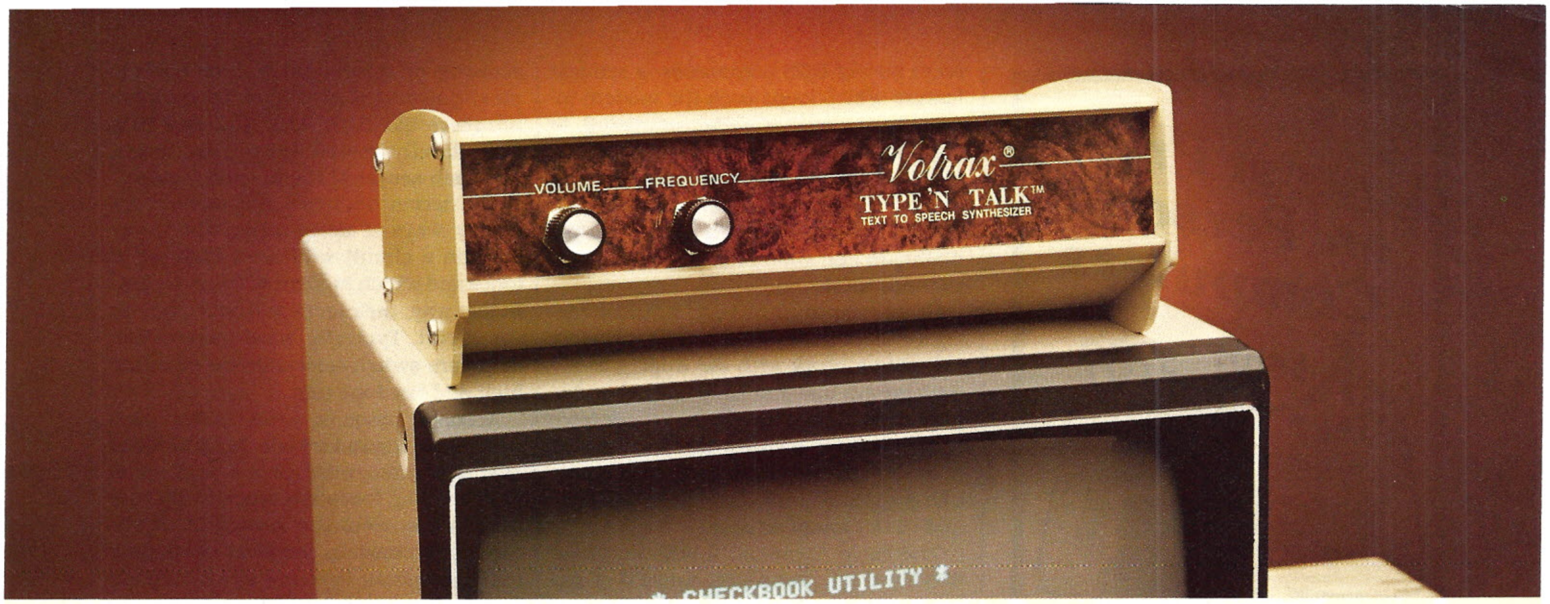
Also, remember that the Novation modem module which is the heart of the Apple-Cat II will soon show up in modems for other microcomputers. These systems should also be able to use the 1200-baud file transfer program.

The program runs from a helpful menu and has other nice features, such as a status line which shows the transmission parameters selected, program features activated, and free memory available; di-



This Novation modem module is about the size of a deck of cards. It will be the heart of a whole new line of modem products for microcomputers.

Address correspondence to Frank J. Derfler, Jr., PO Box 691, Herndon, VA 22070.



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rect entry of DOS commands; a self-test feature which loops back the modem internally; extensive self-customizing to match various printer and external device options; utilities to convert between integer, BASIC and binary files; and a "Hello" program which greets people dialing-in and allows them to leave messages in RAM.

Other communications software designed for integrated modems probably will not yet work with the Apple-Cat II. I understand that Bill Blue and other Apple communications software types have been contacted by Novation, and I expect to see compatible versions of various popular programs, including those in Pascal and CP/M, available soon.

The basic Apple-Cat II sells for about $390 and requires a 48K Apple II or Apple II Plus with a single disk drive and 3.2, 3.2.1, or 3.3 Apple Disk Operating System. The Apple-Cat II hardware includes a full duplex serial port with full handshaking for a printer, so you could eliminate that cost if you need that kind of printer interface. It is a well-designed product aimed at the Apple II owner who wants the ultimate in system flexibility. It isn't low-priced. If you get all of the accessories (tone decoders, ROMs, etc.), the system can cost over $650, but it has integrated capabilites found nowhere else at this time.

Now, let's take a closer look at some modem terms, particularly the Bell 202 standard used by the Apple-Cat II.

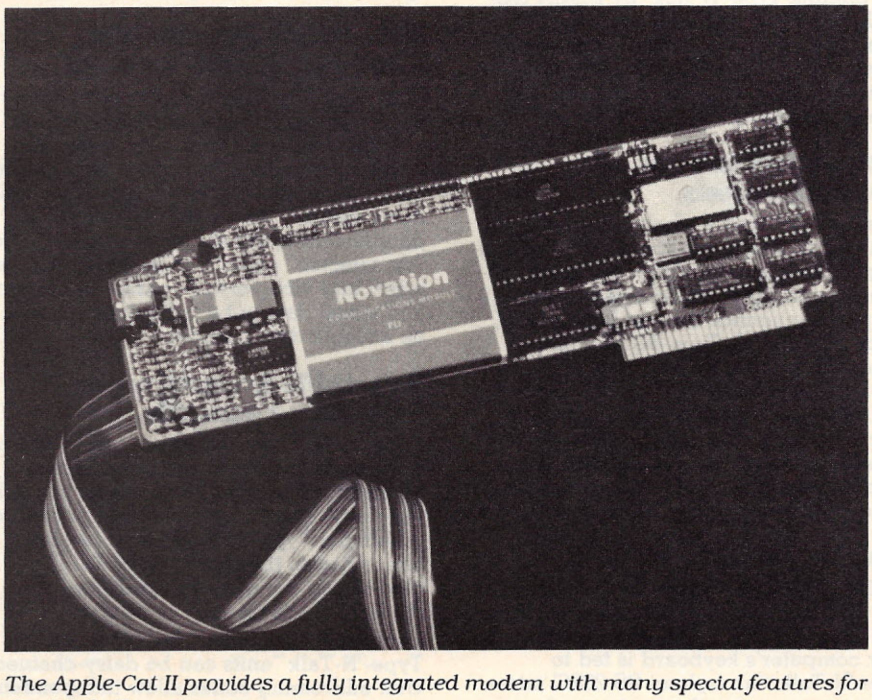
Modem Terminology

If you intend to buy a modem soon (and every reader of this column should have at least one by now!), you may be faced with a new decision. Along with deciding if you want to have originate and answer, acoustic or direct and full- or half-duplex, you might also have to decipher numbers like 103, 113, 202 and 212. Let's briefly review those first terms, and then see what the numbers mean.

The terms originate and answer are simply ways of designating which modem on a circuit will use a high set of tones and which modem will use the low. In that way, their tones will not collide on the circuit. Typically, most modern modems are switch-selectable between the high and low tone sets.

Acoustic modems have rubber cups which hold a standard telephone handset over an audio microphone and small speaker. The tones are acoustically coupled to the telephone system. A direct-connection modem connects electrically to the telephone system—either through a phone jack or by insertion between the handset and the telephone. Direct connection does not mean that the modem is directly connected to the computer's data bus without the use of a serial port, although the phrase is sometimes improperly used in that way. The type of modem which does not need a serial port is sometimes referred to as a bus decoding, integral or integrated modem.

In modems, the terms full- and half-duplex refer to the use of an echo circuit between the modem and terminal. In a full-duplex circuit the distant end echoes back characters so you know the line is good and your data has been received. If a modem is placed in half-duplex, the modem itself will provide the echo back to the terminal or computer serving as a terminal. This is probably useful only in two cases: first, when you want to do a local test to ensure that your data is getting out of the computer to the modem properly, and second, when for some reason the



The Apple-Cat II provides a fully integrated modem with many special features for the Apple II computer.

distant end is not providing an echo and your terminal cannot display its own output. Being able to operate in half-duplex is not a vital capability in a modem.

There Is Life after 300 Baud

Now, for all those numbers. Many modern modems like the Apple-Cat II will provide different kinds of service. The most familiar service designator is the old standard Bell 103. The standards like Bell 103 simply describe the tones and signaling schemes modems use when talking to each other. The Bell standard 113 is identical to 103 except it designates an originate-only modem.

The Bell 103/113 standard describes a signaling scheme using four tones (audio frequencies) which are varied to indicate the 1's and 0's. If you want to sound really technical, you can call this frequency shift keying, or FSK. The 103 signaling scheme is usually considered to be good only up to about 300 baud. At faster speeds, each tone pulse becomes very short. You have to have a very good receiver to quickly detect and recognize the short tone burst. Some modems, notably the Potomac Micro-Magic, can operate reliably up to 600 baud using the Bell 103 FSK standard. At that speed, each bit is represented by a tone only 1.6 ms long.

The 200 Series

The Bell 200 series of modems (they call modems data sets) are medium- and high-speed units. The dial telephone network will not provide enough bandwidth to allow the transmission of 1200 baud frequency shifted data transmission in two directions simultaneously. Each end has to take turns using the channel. This sharing, called half-duplex operation (same words as above, but a slightly different meaning when applied to a communications channel), must be coordinated between the terminals. Sharing is done through the use of request to send (RST) and clear to send (CTS) signals. Full-duplex channel operation can be done at medium speeds using two frequency bands and changing the phase of the signals instead of the frequency.

The 202 standard modems (like the Apple-Cat II) are usually used in big systems in applications called polling. Polling systems periodically call up remote terminals to gather data. The data is dumped in primarily a one-way transmission. The 202 standard uses frequency shifted tones and requires the use of RTS and CTS signals. It is commonly being used by amateur radio operators to transfer data on the VHF bands.

The 212 data set is a dual-mode unit which will operate at 300 baud using the 103 standard or at 1200 baud using a special phase-shifted signaling pattern. Phase-shifted signaling is used at higher speeds because phase can be detected very quickly. The sine wave of a 1200 Hz tone takes about .8 ms to complete. That is about the minimum time it can be sampled except by the use of statistical or linear predictive techniques.

A phase-shifted signal can be measured in units of one cycle divided into 360 degrees. That means that a signal could ideally be decoded in about .002 ms. Bell 212 standard phase-shifted keying is used in high-speed interactive systems including Telenet, Tymnet, CompuServe and The Source. It is not compatible with 202 signaling.

Wait a minute! You mean I can't talk to my favorite information utility at 1200 baud with an Apple-Cat II? Yup—for now, that's correct. Bell 202 FSK signaling was easy to provide within the advanced design of the Novation device, but it is not the system widely used for interchange with time-shared computer/information utilities like CompuServe and The Source. As the cost drops and the popularity increases, who knows?

The 202 standard is widely used in polling systems, and there are many commercial modems available which provide the service; perhaps popularity and customer pressure will prevail. In the meantime, the 202 signaling scheme provides an economical way to exchange data at 1200 baud for users of modern LSI technology modem devides.

If You Never . . .

There is only one way to ensure you never make a mistake: never do anything. Well, I do make mistakes. For instance, in the April '81 issue I attributed the CP/M operating program to the wrong company. CP/M is a product of and trademarked by Digital Research of Pacific Grove, CA. Similarly, in the March issue some telephone numbers were scrambled, so I have included a new listing of People's Message Systems.

If You Do . . .

If you manufacture data communications products or write data communications software, send comments or questions to PO Box 691, Herndon, VA 22070. Include a stamped envelope if you want a reply. Electronic mail is welcome at TCB967 on The Source, 70003,455 on CompuServe or the AMRAD CBBS (703-734-1386). □

People's Message Systems

Anaheim, CA	714-772-8868
Ellicott City, MD*	301-465-3176
Freeport, TX	713-233-7943
Indianapolis, IN	317-862-6191
Los Angeles, CA	213-291-9314
Minneapolis, MN	612-929-6699
Mission Valley, CA	714-295-8280
Lake Forest, IL	312-295-6926
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By Walter Koetke

Software Shopping

Getting the Most for Your Money

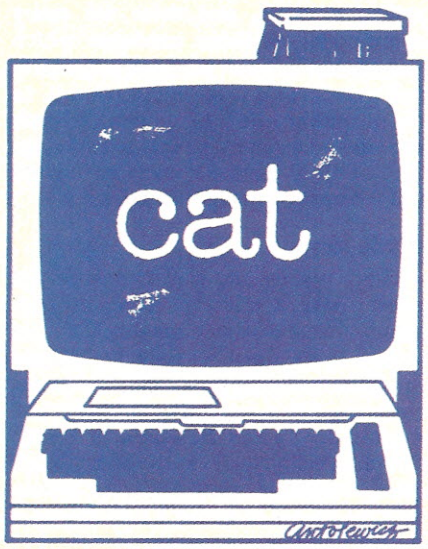
Instructional Software

The potential of microcomputers as instructional tools seems unparalleled. Unfortunately, the state of educational software is in its infancy. Software development lags behind hardware capability throughout the computing industry, but in education the gap is acute.

This software gap can cause several problems. Educators and others who understand the potential of the microcomputer can easily oversell the reality of available instructional support. Because the majority of teachers are not really familiar with the current state of software development until facilities are purchased, they are often severely disappointed. A more lasting danger is that the disappointed teacher will write off the microcomputer as just another gadget and not again be willing to experiment with this new technology. Still others might take the best software they can find and assume that represents the epitome of microcomputer support.

As a dedicated advocate of the use of computers to support instruction, I urge that you not oversell the concept. The positive aspects are so overwhelming that overselling is not necessary. Be sure that any discussion of the microcomputer's educational potential is tempered by a discussion of the educational reality of the available software.

As a consumer, you should distinguish potential from reality by insisting that software be demonstrated. When Random House and Radio Shack announced their joint venture into the educational marketplace, a rather impressive software catalog was produced detailing several desirable and possibly significant pieces of educational software. Where was the software? Could it be purchased locally? Could you arrange a demonstration? No. In fact, the software wasn't available when the catalog was printed, nor was it available some months later as this article was written.



Unfortunately, the appearance of advertisements and even catalogs prior to the completion of the actual software is not at all unique to the specific instance described. My point is not to discuss the motivation behind this business practice, but to make you aware that it exists. Random House and the others who have done this almost certainly expect to eventually deliver everything they've advertised—sometime. And when delivered, it will likely be very close in appearance and function to the product advertised.

However, don't believe any software promises until you actually see the software operating. At the very least, be sure someone whose opinion you respect will say that he or she actually saw the software in operation. Only then should you seriously consider the instructional support that specific software might provide. Never buy any microcomputer hardware for use with software that is still being developed. You're almost certain to be disappointed.

A general rule of thumb in the computer industry at large is that the cost of hardware and software will be about the same. For instructional applications of the microcomputer in education, I suggest the cost of software should be budgeted at a level at least twice that of the hardware. Many teachers, however, have succeeded in convincing their administrators to purchase microcomputer hardware only to discover that almost no money has been provided for software.

An all too frequent request from many teachers is for help in spending their annual $100 to $200 software budget. There is no doubt that this amount of money is insufficient, but that is not a helpful answer. The fact remains that the stated sum is their budget and they want to make the best of it.

I recently encountered a response to the very specific question, "How shall I spend $150 on instructional software for a TRS-80?" The response was written by Robert W. Jackson, Mead School, 2 Andrews Road, Greenwich, CT 06830. Bob is a teacher with a large collection of instructional software and a good deal of experience using microcomputers with students. Bob's response is included here with his permission and with very little change from the original:

"I accept the challenge. We only have $150 to feed your 16K cassette-based TRS-80. First I must warn you that I am heavy into using games as a means of approaching the traditional subjects. This is a personal approach which is not accepted by many schools, which explains why I teach at the Mead School. The Mead School is a hotbed of innovative ideas.

"Our first purchase was from Softside, 6 South Street, Milford, NH 03055. We

Walter Koetke, Putnam/North Westchester BOCES, Yorktown Heights, NY 10598.

wanted to purchase the December 1980 issue of *Softside* and the tape for that month. For our $9.95 we received a great game magazine with programs for our kids to enter and some good tips. Kidnap is an adventure game which will teach kids typing and word skills, logic and common sense, and exercise their imaginations. Word Problems alone is worth the $9.95. Space Dodge and Missile Evasion are extras. Also, we wanted to purchase ten short cassettes for $7.95. We will use these because they will hold two programs per side. This will save us a lot of time instead of trying to find programs on a 30-minute tape.

"Our next purchase was from Basics and Beyond, Box 10, Amawalk, NY 10501. The best math package for the TRS-80 is the Math K-8 from Radio Shack, but at $200 it is out of our budget. Basics and Beyond's Microcosm III costs $24.95 postpaid and consists of 20 programs with sound (but they only run on 16K machines). Two programs here are worth the whole package for us. These are Multiplication and Division, each of which is a step-by-step drill. Personally, I liked the music programs because Mead is right-brain-oriented. The rest of the package is a bonus. Many programs will be useful in other areas. If you happen upon some more money, I would also recommend purchasing their Microcosm I and Microcosm II.

"Now off to Radio Shack. We want to purchase their small gray amplifier for $11.95 and a machine-language program called Space Warp (also sold under the name of Timetrek). The amplifier plugs into the cassette cable and gives us sound. Space Warp costs $14.95. We have now spent $70.

"Next we write an order to Adventure International, Box 729, Casselberry, FL 32707, for Wordchallenge, a versatile word-guessing game at $9.95. You can change the data statements and save this program on several cassettes, one for social study words, one for English words, one for metric words, Spanish, French and so forth.

"Now we can relax. We've covered math and language and we have about 25 games to boot. Do not release all the games at once. Introduce them two at a time over the year. Kids quickly become bored once they have mastered a particular skill. Next we'll explore literature. For $20 we will get a subscription to *Creative Computing*, which is full of useful programs every month along with tips for our computer literacy class and a few educational articles for the principal. *80 Microcomputing* is a good deal at $24 a year, but the programs are too technical for us right now—maybe next year.

"Next we want to purchase the Word Watch set of four programs for $7.95 plus postage from Instant Software, Peterborough, NH 03458. This is money well spent. We will have to gear the data down to the level of our kids, but these four programs will pay for themselves. Wordrace is a two-player word game, and we like two-player games because that means two kids will get to use the few computers we have. Spelling Bee and Word Drill are just barely OK. Hidespell is good.

"Ten dollars goes to Med Systems, PO Box 2674-W, Chapel Hill, NC 27514, for a game called Playful Professor that teaches the basic four math functions and fractions. Our expenses so far are $122.

"Your next $13 goes to Omnitek Systems, 24 Marcia Jean Drive, Tewksbury, MA 01876, for Typing Tutor by Microsoft. We are going to start a typing course. Next year when the administrator wants to purchase typewriters, we will tell him that word processors are the typewriters of the future, so he will spend the money on computers instead. This program will impress the rest of your staff and gain respect for the computer. It is based on timed response methods. It measures the time between strokes to determine which fingers are weak.

"Our last hard-fought-for $15 goes to Program Design, Inc., 11 Idar Court, Greenwich, CT 06830, for a program called Vocabulary Builder 1. This set of programs teaches synonyms and antonyms using a simple drill format.

"You may well be asking, 'Why so many different vendors?' It is good to get on as many mailing lists as possible so that we are informed of new software and hardware products.

"Since we have not yet used all of our money, this is not the end of our hunt. With $4 from some other fund, we join the Computer Using Educators Group (Don Mckell, Independence High School, 1776 Education Park Drive, San Jose, CA 95133). This gets us four newsletters a year, and for $10 they will send us a disk full of public domain teacher-written programs.

"When time permits, we write a few programs of our own and then write to Dr. Earl Savage, Craig County Public Schools, PO Box 245, New Castle, VA 24127. He will send a catalog of programs for which we can trade our newly created programs. During the year our kids are typing programs from the new magazines to which we have subscribed. Other teachers come to us with ideas for programs that the kids can create.

"Craig Walker is the author of the Arrowsmith Individualized Math program, which is free for the asking and is on both tape and workbook so you can use it either way. Contact him at 2299 North G Street, San Bernardino, CA 92404."

There is both experience and thought reflected in Bob's response. If you find yourself in a situation similar to the original recipient of his advice, his comments should provide an excellent guide to a successful beginning.

✓See List of Advertisers on page 194

When today's software is compared to the instructional potential of the microcomputer, none of it seems very good. You should, however, select the best of that which is available and help evolve that potential.

As is often the case in many situations, having money does not always mean our needs are readily filled. A teacher recently asked me for suggestions regarding the most effective way to spend an available $1000 on software for the Apple II which could be used to assist the teaching of reading. I invited this teacher to spend a day in the software resource center for which I'm responsible. She accepted this invitation. Because her interest was very specific, she was able to actually run every piece of related software available as well as scan the advertisements in a representative sample of current magazines.

At the end of the day, her quite correct conclusion was a surprise. She planned to purchase every piece of reading-related software she had sampled in the resource center as well as purchase every piece of reading-related software she had seen advertised. The surprise was that all of these purchases did not even come close to consuming the entire $1000.

The point is not that the resources examined were inadequate. They were, in fact, very complete. There just isn't very much commercially available instructional software—good or bad—that will assist the teaching of reading. Software development does indeed lag way behind hardware development.

For those interested in the teaching of reading, there is some good news. Now you can spend your full $1000 allotment for software. Since the occurrence of the described incident, Borg-Warner Educational Systems, 600 West University Drive, Arlington Heights, IL 60004, has released the large Critical Reading software package for $750. According to Borg-Warner:

"The Critical Reading program is designed to help a student think critically about written discourse. It introduces the student to basic rules of logic and provides drill and practice in reasoning skills which will aid in overall comprehension of reading material. This program includes automatic diagnostic and prescriptive pretests, instructional lessons with recycling capabilities, progress checks after each lesson to test the student's comprehension of materials and posttests. The management file on each disk stores student records in up to eight assigned reading groups. The management system also maintains and adapts individual student prescriptions on the basis of the entry diagnostic test and ongoing student performance on the lesson material. Because of its self-pacing capabilities, Critical Reading may be used for developmental, remedial and gifted student instruction."

I suggest taking a look at the Borg-Warner material. While there are certainly some valid criticisms regarding their software (see the February 1981 *AEDS Monitor*), the package is a good one. When today's software is compared to the instructional potential of the microcomputer, none of it seems very good. You should, however, select the best of that which is available and help evolve that potential.

Several articles have explained the enormous cost of developing good instructional software. The usual source of these articles is one of the more traditional publishers who has recently entered the software business or one of the vendors of minicomputers. My concern now is not to dispute the stated costs—perhaps another time.

My concern is for the large number of good instructional programs that have been written by the teachers who are using them with their own classes and which have been shared with almost no one beyond those classes. Each week the resource center for which I'm responsible discovers—usually by accident—another piece of very good teacher-produced software. Most of these are worth sharing with other teachers, and many are good enough to have commercial possibilities. If you have original instructional software that students enjoy, I urge you to explore the possibility of marketing your material.

A good starting point would be any of the companies mentioned in the letter written by Robert Jackson. The only word of caution is to be sure your program is original. A slightly modified program you entered from a magazine may be super for your students, and I encourage you to use this approach. Selling that material, however, is illegal.

On the other hand, if you had an idea and then implemented the entire program yourself, by all means contact one or more of the publishers. Even with higher postal rates you're risking very little, and there's always the chance that you can sell a great many copies.☐

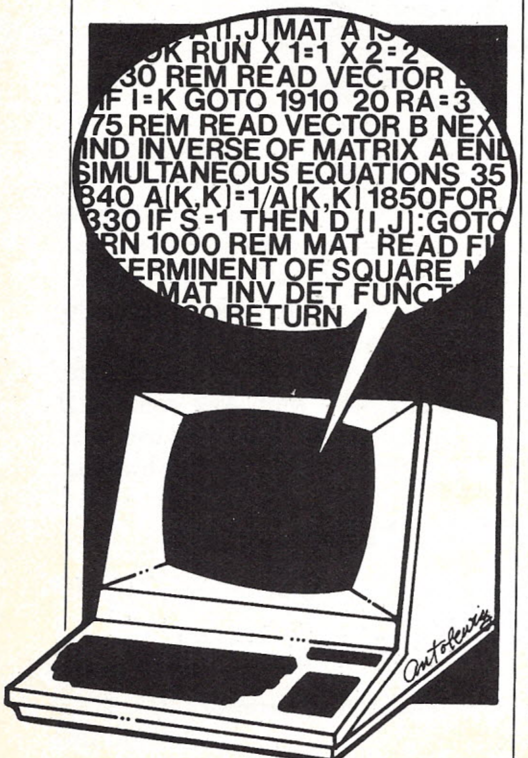
By Eric Maloney

Acronym Crisis

Relief Needed ASAP

The computerist does not live by acronyms alone, but he'd give it a try in a tight pinch.

Charles J. Sippl's *Computer Dictionary and Handbook* devotes 19 pages to acronyms and abbreviations. The A's alone include A, ABC, ABM, ABO, abs, AC, ACA, ACD, ac/dc, ACI, ACIA, ACK, ACTS, ACU, AD, ADA, ADC, ADCCP, A/D, ADDAR, ADONIS, ADP, ADPC, ADPE, ADPS, ADR, ADS, ADX, AF, AFC, AFG, AGC, AIG, ALC, ALE, ALGOL, ALT, ALU, AM, A/M, AMC, AM-DBS, AMP, AMR, AM-SSB, ANACOM, ANATRON, ANI, ANSI, ANT, AO, A-O, AMPL, AOC, AOS, APC, APD, APL, APOTA, APP, APRXLY, APT, APTS, APUHS, APULS, AQ, AQL, ARAM, ARC, ARL, ARM, A Q, ART, ARU, AS, ASC, ASCC, ASCII, ASD, ASK, ASLIB, ASLT, ASN, ASP, ASR, ASV, AT, A/T, ATE, ATS, AUTOPIC, AVD, AVE and AVL.



It is no wonder that editors often feel like they're drowning in a vat of alphabet soup.

A fresh new acronym crisis awaits the editor in nearly every manuscript. For instance, when are acronyms all capitals, and when are they all lowercase? *Microcomputing* lowercases ac (alternating current), afc (automatic frequency control), cps (characters per second), rf (radio frequency) and swr (standing-wave ratio), among others. Why? Simple—that's the way we've always done it.

Another problem: when do acronyms metamorphose into words? The English language is loaded with precedents: radar (radio detecting and ranging), sonar (sound navigation ranging), scuba (self-contained underwater breathing apparatus), laser (light amplification by stimulated emission of radiation) and rem (roentgen equivalent man) are a few examples. Computerese has several candidates, most notably computer languages such as BASIC (Basic), COBOL (Cobol) and FORTRAN (Fortran).

Editors and computerists haven't yet made up their minds. One magazine prints BASIC, and the other prefers Basic. One computerist PEEKs and POKEs, while his neighbor peeks and pokes.

Unfortunately, many computerists have taken to capitalizing words that shouldn't be capitalized. Take Pascal, for instance—even Sybex's *Microprocessor Lexicon* lists it as PASCAL. But Pascal, unlike many other computer languages, is not an acronym—it is the name of a person.

Speaking of computer languages, how many people can recall what COBOL, BASIC and FORTRAN stand for? Probably not too many. I suspect that all three will become upper-lowercase words in time.

* * * * *

Anthropomorphisms continue to creep insidiously into computerese.

From Percom comes a news release with the following: "The burn-in test uncovers latent defects that might cause 'infant mortality' failures."

Meanwhile, a press release from Infoscribe includes the line "An elevated temperature testing room is being constructed to ensure the elimination of infant mortality in electronic components."

There is something disturbing about the phrase "infant mortality" when used in connection with electronic parts. The words death or die, when used in such a context as "my car died today," are colloquial, so broad in meaning that they carry no loaded implications. But the term "infant mortality" refers to a set of social, economic and human problems that evoke a highly emotional reaction from many concerned people. Its use to denote malfunctions in electronic components borders on flippancy and bad taste.

It certainly gets the point across. But a nice, neutral term like "early failure" more than suffices.

* * * * *

In reference to the May column ("A Language of Their Own: Time to Reeducate Educators," p. 26), Raymond Kostanty of Wood-Ridge, NJ, writes that I shouldn't be too harsh on Webster for not including the word indepthly.

"Here are two other words, both from

Phrases—The Long vs the Short

a number of	many
according to our records	we find
as a result	thus, hence, therefore
at an early date	soon, now
at the present time, at this point in time	now, right now, to date, at present
at this stage	to date, so far
at your earliest convenience	soon, now
available evidence indicates	unavailable evidence can't indicate anything; omit available
due to the fact that	because
enclosed please find	here's
finalized our decision	decided
for the purpose of	for, to
for what reason	why
has the capability of	can
in accordance with	by, under
in actuality	actually
in addition	besides, also, too
in addition to	besides, on top of
in advance of	before
in as much as	since, because
in conjunction with	along with, and, with
in juxtaposition to	side-by-side with, next to
in order for	for
in order that	so that
in order to	to
in our opinion	we believe
in some cases	sometimes
in the amount of	for
in the event that	if, in case
is unable to	can't
it goes without saying	clearly, obviously
it is obvious that	clearly, obviously
make a determination	decide
manifests itself as	shows up as
more importantly	more important
prior to	before
reflects a balance of	shows
until such a time as	until
with the result that	so that
each and every	each, every
were unable to	couldn't
all of	all (keep of if the next word is a pronoun)
up to this point	so far
in spite of	despite
a variety of	many

the May issue, he also forgot the list: the verb trash ('Trash Your Typewriter,' on the cover) and the verb keyboard ('Those members with terminals keyboard their articles into a file . . . ,' on the 15th line of page 94)."

Well, I'll defened the word trash; it's a rough, unsightly bit of slang, which is precisely what we wanted in that situation. Keyboard, on the other hand, is pretty dreadful as a verb, particularly when there's a nice clean one like type waiting to be used.

* * * * *

Last month's column listed 14 networks or products that end with "net." Since then, 13 more have popped up: Hi-Net, FundsNet, Avnet, Omninet, M/NET, IBS-NET, CSNet, Arpanet, Phonenet, Internet, Z-NET, DECnet and AGNET. Fishnet and Hairnet haven't arrived yet, but it's only a matter of time.

* * * * *

Raymond Kostanty (see above) submits the accompanying list, "Phrases—The Long vs the Short." It's surprising how much you can tighten a piece of writing by knocking out some of the unwieldy verbiage.□

MICRO QUIZ

What Does This Program Do?

What is the sum of all of the different values that Z takes on during the execution of the following program?

```
DIM S(10)
S(1)=1
Z=-1
FOR I=2 TO 10
     S(I)=S(I-1)+2
     Z=-S(I)*S(I-1)/Z
NEXT I
```

(continued on page 172)

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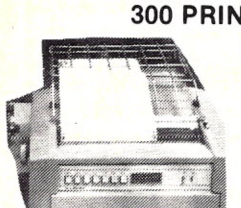

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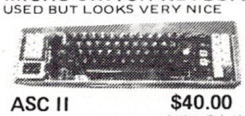

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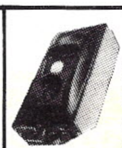

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Compiled by Eric Maloney

The Best Of the West

Computer Faire Trots Out More of the Same

Erstwhile reporter Dennis Bathory Kitsz submits the following report on the West Coast Computer Faire last April:

This year's West Coast Computer Faire, the sixth annual event of its kind, was marked primarily by large quantities of the same old thing: look-alike computers, violent game software, sexist T-shirts and hype. There was old technology repackaged (Commodore's VIC computer), old software not repackaged (those Apple "music" programs), old technology in new guises (a 60-pound prototype of a "portable" businessperson's computer) and peculiarly matched electronic devices (a 30-megabyte disk drive on a TRS-80). Bizarreness abounded, such as the plywood-encased barroom version of Atari computers, and a beautifully designed Stratos microcomputer in a for-the-person-who-has-everything teakwood cabinet. The show was also notable for its absentees, particularly the folks from Apple, who had nothing to show and may well have traded their company back for the VW bus.

Nevertheless, the Faire was an exciting event because almost the entire range of present microcomputer technology and ideas was visible, and because nearly 35,000 people attended the three-day show. Among the most interesting ideas on exhibit: John Bell Engineering's miniature control microcomputer kits; a fast Fourier transform program showing the frequency spectrum of music in a real-time bar graph; a Canon desk computer armed with built-in double Exatron stringy floppies; and the newer Sinclair ZX-81 micro using programmed logic arrays to reduce its chip count to a half-dozen (and prevent bootlegging).

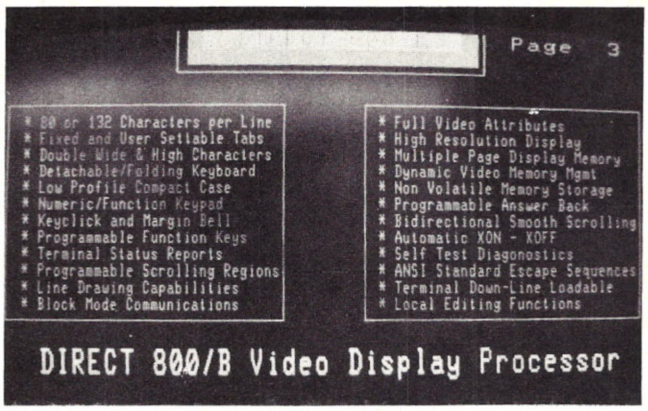
Other items of moderate interest included a complete computer kit that is software compatible with the TRS-80, but with high resolution and color graphics; the heavy use of Epson MX-80 printers for demonstrations on many machines; high-quality video terminals with excellent resolution and gray scale; and voice input/output software/hardware with considerable improvements of accuracy and clarity.

There was evidence of the continued fall of prices for small hardware. Once over $200, complete sets of eight 16K dynamic RAM chips (fast, 200 ns types) were available by show's end for $17. Also very costly at one time, type 2716 erasable memories (2048 bytes) were selling for $7. Static RAMs were inexpensive, with workhorse 2102 memories selling for 50 cents and 2114 and 2118 memories available for $3 and $10, respectively.

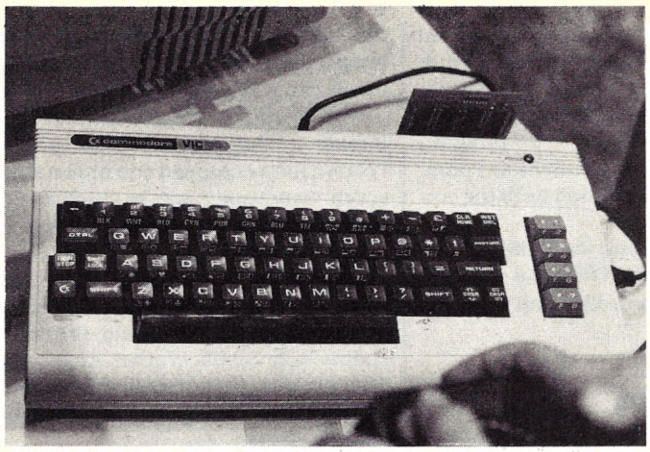
This year's Computer Faire was truly the show of the word processor. At least two dozen new systems were in evidence, from full-featured, complicated, office-style systems to stripped-down programs for under $10. The real breakthrough in word processing, however, was the appearance of two functioning, expandable, 20,000-word-plus dictionaries that work accurately and quickly: Hexspell and Microproof, both currently for the TRS-80. Entire documents can be proofread for words not found in the program's dictionary, and these are presented for inclusion or alteration. The programs are fast; Microproof completed a 2000-word document in under 30 seconds.

People were also news at the Faire: Adam Osborne presented his new microcomputer; Wayne Green and Sherry Smythe courted TRS-80 users on the floor; Steven Ciarcia pulled circuit boards from every pocket; Robert Purser (*Purser's Guide*) was at his dapper best. Carl

View of the main floor of the West Coast Computer Faire. Nearly 35,000 people attended the three-day event.



Direct Video video display processor combines high-resolution graphics and gray scale for a versatile, interactive display.



The Commodore VIC was shown at the Faire: a line of children queued up to play games using the VIC's color graphic display.

LNW-80 is a complete TRS-80 compatible kit. It offers an expanded keyboard, color and high-resolution graphics. All TRS-80 software will run unmodified on the LNW-80: the bare board costs under $100.

Helmers, Don Lancaster, Sol Libes, David Ahl and many others conducted seminars and met attendees.

EYP Delay

Six months ago, AT&T was moving full-steam ahead with a free experimental electronic yellow pages service in Austin, TX. But the Texas Daily Newspaper Association has set up a roadblock by convincing the state Public Utilities Commission to delay the project until a variety of questions concerning AT&T's role in data communications are cleared up.

The PUC ruled that the project was not experimental but a home marketing test, and therefore required a public hearing and commission certification. AT&T appealed the ruling to a Texas state district court, but the court upheld the PUC decision. Joining the TDNA against AT&T were Datapoint Corp. and Tandy Corp.

The public hearings are slated to begin July 6.

The proposed Austin videotext service is the latest step by AT&T to enter the electronic information services business. The company has also launched videotext experiments in Albany, NY, and Coral Gables, FL, the latter with Knight-Ridder Newspapers.

The controversy surrounds a ruling by the Federal Communications Commission called the Computer Inquiry II which reinterpreted a 1956 consent decree that barred AT&T from entering unregulated telecommunications markets. The FCC said that AT&T could be an information provider as well as a carrier as long as it established a separate subsidiary for that purpose.

The Justice Department disagreed, and in March AT&T went to a US district court in New Jersey to clarify the meaning of the 1956 consent decree.

The newspaper industry has fought AT&T every step of the way. The feeling is that AT&T—whose assets exceed the combined assets of the entire newspaper industry—is in a position to completely dominate the electronic information market, thus seriously cutting into newspapers' classified advertising revenues and infringing upon their function as an information provider.

As one publisher said at the 1980 International Newspaper Advertising Executives conference, "he who owns the database owns the ballgame."

The Coral Gables experiment, called Viewtron, was coordinated by KRN subsidiary Viewdata Corp. of America and AT&T subsidiary Southern Bell.

	1980	1985	1990
Video			
Programmable	220	275	295
Non-Programmable	90	5	0
Total Video	310	280	295
Nonvideo			
Nonvideo Games	510	675	820
Learning Aids	220	295	360
Electronic Chess and Similar	170	220	275
Home Arcade Games	40	50	65
Total Nonvideo	940	1240	1520
Total Electronic Game Market	1250	1520	1815

Ten-year projection of manufacturers' sales of electronic games, in millions of dollars. (Source: International Resource Development, Inc.)

Micros vs Video Games

The electronic games market will stabilize, says a recent report from International Resource Development, but faces a "major threat" from the growth of home computers.

The nonvideo segment has managed to avoid problems by incorporating hardware and software—as in electronic chess—in such a manner that a microcomputer program can't duplicate it. But, the report says, it will make little sense for the home computerist to buy video games when he can pick up a microcomputer software package for much less.

The IRD says that electronic games manufacturers will take three courses of action:

- Some companies, such as Bally, will withdraw from the market.
- Others, such as APF Electronics, will make games that can be upgraded to computers.
- Finally, some companies will start making microcomputers. Atari is the most obvious example of this strategy.

The report says that success in the electronic games market will come to those who incorporate such new technologies as voice synthesis and holography.

Educators on Piracy

The Wyoming Science and Mathematics Teaching Center at the University of Wyoming in Laramie has issued a policy statement of software piracy which it

hopes will be adopted at the National Council of Teachers of Mathematics this fall.

"If a program's listing or written documentation contains a claim to authorship or if the media has electronic guards against copying or listing the program, unauthorized reproduction of the program will be deemed as constituting larceny," the statement reads.

The SMTC is involved in exchanging teacher-authored software and evaluating commercial software. The Center has issued a second statement which says that it "will not participate in the unauthorized reproduction or exchange of any computerized courseware which bears an explicit or implicit copyright."

"I have not seen a similar statement from any other school and I would like to see this kind of commitment become common," says John C. Russell of the Center.

TI LOGO

Texas Instruments has released its own version of LOGO, the children's computer language developed by Seymour Papert and the Massachusetts Institute of Technology LOGO lab.

TI LOGO runs on the TI 99/4 microcomputer. The child uses the keyboard to draw geometric shapes and figures and make them move. LOGO is designed to stimulate the child to analyze his task, and in the process become conscious of how he solves problems. The program lets them try different solutions to a problem, modifying the solution until the correct one is reached.

TI LOGO is retailing for $299.95. The software requires the TI-99/4, a monitor, disk drive, disk controller and memory expansion unit.

Cable in Boston

A hint of things to come in cable television was provided by the only two companies left in the running for Boston's cable franchise.

Cablevision Systems of Woodbury, NY, and Warner-Amex, owner of the QUBE system in Columbus, OH, disclosed their offers to the city of Boston last April after six other bidders dropped out.

Most interesting were the provisions for community access to the cable. Both bidders were required by the city to offer in their proposal 5 percent of their gross revenue to a nonprofit corporation for community access and local programming called the Boston Access and Information Corp. In addition, Cablevision offered $500,000 to the BAIC during the first two years, $500,000 toward a downtown studio, and an undetermined number of two-way viewing centers.

Warner-Amex, meanwhile, offered $1 million to the BAIC over the first two years, a fully-equipped downtown studio, seven community access studios, a city hall studio and 20 public viewing centers.

Cablevision would provide a maximum of 72 channels for $8 a month, while Warner-Amex would provide 62 channels for $9.95. Warner-Amex would also provide their two-way interactive QUBE system for $3.95 and 11 free channels for elders.

Other features of the Warner-Amex service would include the three "superstations" from Chicago, Atlanta and New York; two national sports channels; Cable News Network, and the children's network Nickelodeon.

Cablevision would offer the Cable News Network, two national sports channels, the Chicago and Atlanta superstations and a variety of other special-interest channels.

The firms' six competitors dropped out apparently because of the 5 percent allotment of the BAIC. This is on top of 3 percent that will go into the city's coffers. Several bidders stated simply that 8 percent was too much.□

LETTERS TO THE EDITOR

Super Service

Being fully aware of your continuous concern for honesty, service and dependability on the part of your advertisers, I thought I would let you know of my fantastic experiences that I've had with one of your advertisers.

Aardvark Technical Services of Walled Lake, MI, has been absolutely unbelievable. Owner Rodger Olsen must have an in with the postal service. I can phone in an order on Friday and have it in Naples, FL on the following Monday.

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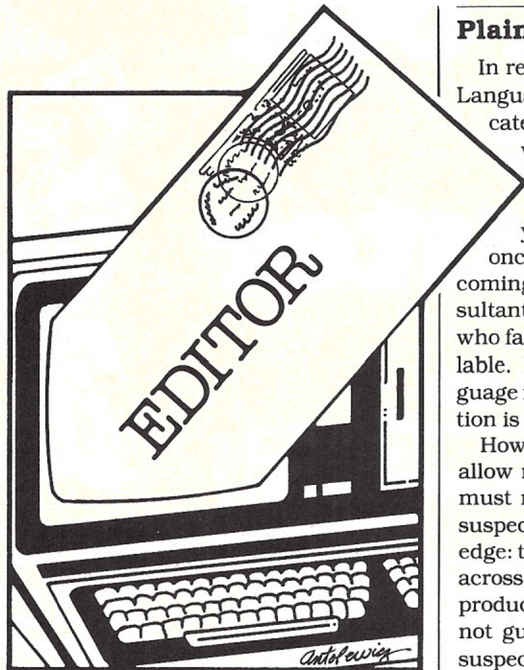
Ron Haltermon
Vice President
Car-ron Enterprises, Inc.
Computahome Division
Naples, FL



Shorter, Quicker, but Harder to Program

Edward Rager's Scramble program (*Microcomputing*, January 1981, p. 78) sacrifices memory and execution time to shorten program development time (structured programming does the same thing).

Listing 1 is a rendering of Scramble for the TRS-80 II (Microsoft BASIC) that ate programming time to conserve memory and execution time. It generates scrambles of any word of length greater than 1 in the same order Rager's program generates them. Contrary to Rager's, it does not print the same scramble more than once when the word has repeated letters.

Since Scramble may never have been written had the programming been difficult, and I would never have revised it had the program not been written, maybe there's a place for structured programming after all.

William A. McWorter, Jr.
Mathematics Dept.
Ohio State University
Columbus, OH

```
10 DEFINTA - Z:INPUT"WORD TO SCRAMBLE";A$:N = LEN(A$):DIMP(N):B$ = MID$(A$,1,1):FORI = 2TON:
   T$ = MID$(A$,I,1):IFINSTR(B$,T$) = 0THENB$ = B$ + T$
20 NEXTI:M = LEN(B$):DIMF(M + 1,1):FORI = 1TOM:T$ = MID$(B$,I,1):T = 0:FORK = 1TON:T = T + SGN(INST
   R(MID$(A$,K,1),T$)):NEXTK:F(I,1) = T:NEXTI:K = 1
30 FORI = KTON:FORJ = P(I) + 1TOM:IFF(J,0) = F(J,1)THENNEXTJ:GOTO50
40 F(P(I),0) = F(P(I),0) - 1:P(I) = J:F(J,0) = F(J,0) + 1:NEXTI:L = L + 1:FORS⁵1TON:LPRINTMID$(B$,P(S),1);:NE
   XTS:LPRINT" ";:I = N:IF(L + 1)*(N + 1)>80THNL = 0:LPRINT
50 F(P(I),0) = F(P(I),0) - 1:P(I) = 0:K = I - 1:IFK<>0THEN30
60 LPRINT:LPRINT:RUN

TAP TPA ATP APT PTA PAT

STOP STPO SOTP SOPT SPTO SPOT TSOP TSPO TOSP TOPS TPSO TPOS OST  POSPT OTSP
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Listing 1.

Plain Talk

In regard to Eric Maloney's article, "A Language of Their Own: Time to Reeducate Educators" (May, p. 26), I want to voice a hearty "amen!" to the points made. Having been a public school teacher for 16 years, I have cringed more than once at the spoken and written drivel coming from certain administrators, consultants or college of education types who fancy they are being paid by the syllable. Indeed, their misuse of the language is one of many reasons why education is constantly under the public gun.

However, since Mr. Maloney seemed to allow no exceptions to his indictment, I must remind your readership of what I suspect Mr. Maloney would acknowledge: there are many, many fine teachers across our 50 states who are in positive, productive contact with children and are not guilty of the charges in question. I suspect those teachers who are competent and confident in the classroom, feeling no need to escape to seats of greater authority, reflect the competence and confidence in simple, clear, concise language.

One more suspicion I must express. Members of other professions such as medicine and law surround themselves with a complex language all their own. The common citizen can only pay high fees to get a translation. But teachers deal with kids, and everybody knows that dealing with kids is no mystery, right? After all, lots of us are parents. So teaching is a simple profession—a teacher tells a kid what to do and the kid does it.

My suspicion is that maybe some members of our profession subconsciously react to these gross oversimplifications by attempting to build up our own special "Latin," hoping to bring about some kind of respectability they sense is missing. Unfortunately, as Mr. Maloney points out, the plan backfires.

John C. Russell
Science and Mathematics
Teaching Center
The University of Wyoming
Laramie, WY

Micro Broadcast

I am producing a weekly communications magazine program in English for the Dutch External Service which is broadcast on short-wave to a worldwide audience each Thursday.

(continued on page 195)

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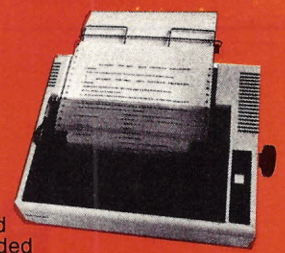

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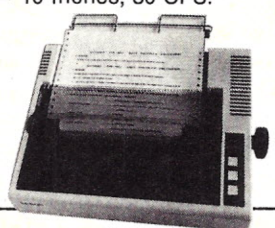

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The latest rung on the mass storage evolutionary ladder is hard disk.

Right on Target With Winchester

By Martin Moore

A few years ago, the gang at IBM was sitting around thinking about information storage. They wanted a way to increase information density and reliability in a mass storage device. They decided on a new disk drive, with the ability to store 30 megabytes of data on 30 tracks.

Then, some sports-minded individual noticed that the numbers 30-30 were the same as those of the popular 30.30 rifle manufactured by Winchester. Though IBM never got around to building the 30-30, and though the specifications changed, the name stuck.

You might be asking yourself what the Winchester has to do with you, the owner of a small microprocessor-based computer. Perhaps nothing right now. But the future is a different story. Shugart Technology is already offering a 5.25-inch Winchester drive, and others are sure to follow.

But before we look at the Shugart and the events that led up to it, let's review some other forms of mass storage.

The First

Of course, the first mass storage device (aside from paper tape or punch cards) was core memory. Put a ferrite bead where two wires cross and you have a memory cell. Use 12 million beads and you can store 12 million bits of information. And, it's nonvolatile. It won't go away unless you tell it to. Add your core memory to a computer with a giant power supply, and you have a computer with mass storage—and a giant power supply.

This kind of memory is fairly reliable if you don't break a wire. In fact, core memory (Fig. 1) is still around in a lot of pre-integrated circuit computers.

There had to be a better way.

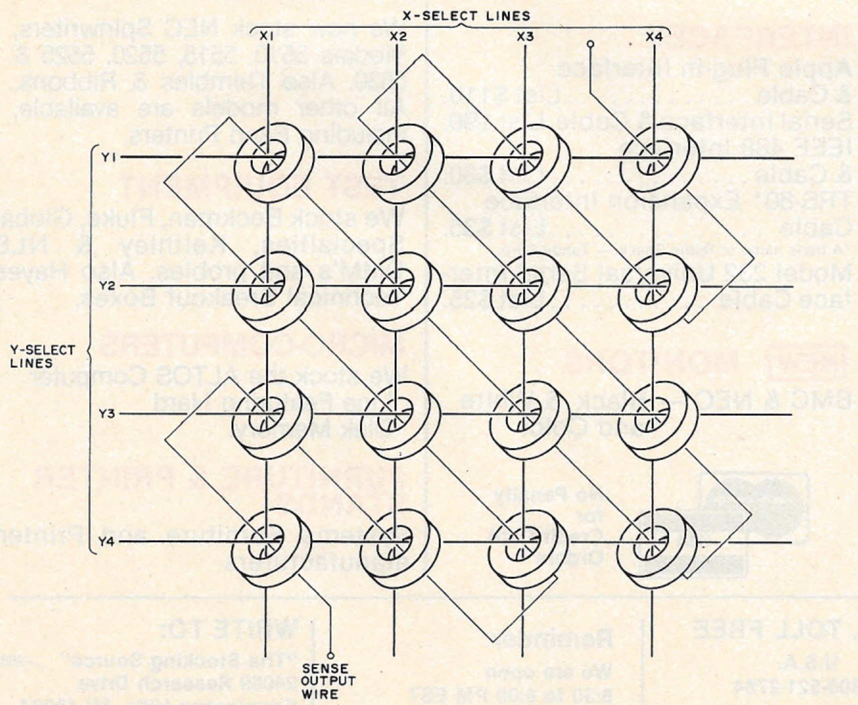

Fig. 1. The venerable ferrite-bead core memory. Each bead is selected by an XY coordinate. The state of each bead is read by the Sense Output wire.

The Oxide Way

The computer people looked around and noticed it was the 1950s, and other people were recording their voices on tape recorders. In other words, they were storing information. The computer people said to themselves, "Aha! We can do that!" And they did, on reel-to-reel, vacuum-column tape transports.

As exotic as they might look, the tape transports still work the same as your $50 portable cassette recorder. Tape leaves the reel and runs across read/write heads, and information is either recorded or played back. What changed over the years was the oxide placed on the tape, and the speed and density at which information could be stored. This, and an improvement

Martin Moore's article "Building the H-89" was Microcomputing's March 1981 cover story. Address correspondence to 2735 S.W. 229, Aloha, OR 97006.

in head technology, helps the tape transport remain a valuable tool today. Some of us couldn't get along without it.

The trouble was, computers kept getting faster and faster, and tape transports couldn't keep up. What was next?

Round Tape

My fertile imagination leads me to believe that the record player was the progenitor of the disk. Information was being stored on this flat thing that went round and round, and once again someone said, "Hey, we can do that!" And they did.

Except they realized that not enough information could be stored in grooved plastic. So, they took that oxide-coated plastic from their tape transports and attached it to an aluminum platter. Then, they took the read/write head off the transport and connected it to a moveable arm. Spin the disk, put the head wherever you want it, and you've got hard disk storage. You could rapidly move the head wherever you wanted on the disk, unlike the tape transport, which had to move the tape to the head. It worked just fine.

The Hard Disk Matures

In the years since the introduction of the hard disk, technology has been at work improving it. The read/write head was refined to make it smaller and lighter. The head was attached to a stepping motor so you could place the head into the same position every time. And the medium (the oxide) improved, too.

One of the things they found was that the closer you move the head to the medium, the more densely you can record information. But the head couldn't touch the surface of the disk, because at 3600 rpm, the head would gouge out a considerable amount of oxide. But, before we go any further, let's take a side trip.

The Floppy Revolution

"Too expensive!" came the cry. The hard disk was a great idea, but couldn't something be done to lower the cost and still provide the high densities and data transfer rates? And the eight-inch floppy was born.

The idea was to put the oxide on a flexible piece of Mylar, put the Mylar inside a low-friction jacket and spin the disk inside the jacket at one-tenth the speed of the hard disk. The read/write head was placed right on the surface of the disk, while the disk spun at about 300 rpm, instead of 3600 rpm. Single-sided storage became double-sided storage, and single-density recording became double-density recording. Then, the floppy shrunk from its eight-inch diameter to a mere 5.25-inch diameter.

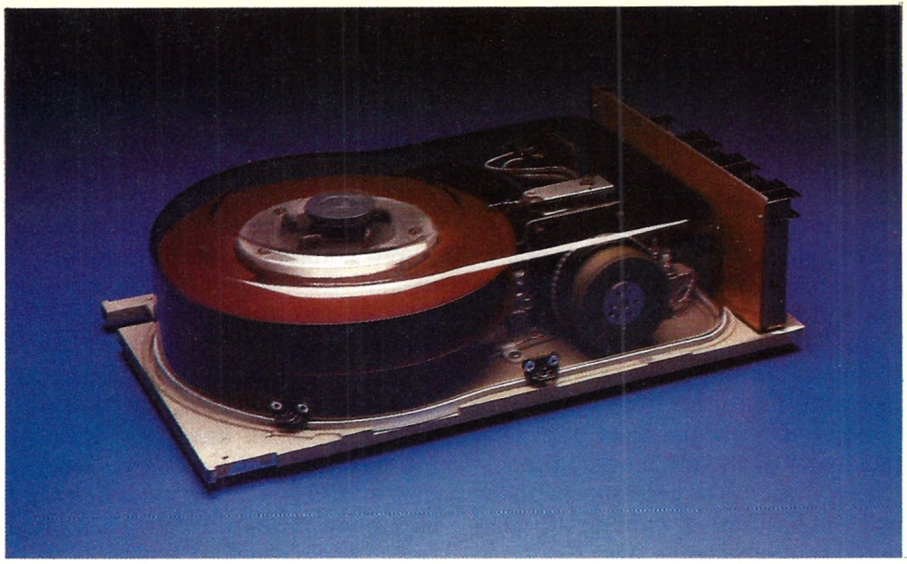

Photo 1. The Memorex Model 101 eight-inch hard-disk drive. This drive uses Winchester Technology and a stepper motor actuator. (Photo courtesy of Memorex)

Shugart Associates came out with the 5.25-inch minifloppy in 1975. The price barrier of the eight-inch floppy was broken. And, we can see what single-sided, single-density 5.25-inch floppies cost today—some less than $300.

But, the story's not over. Let's go back to the hard disk to examine the technology a little, and we'll see what led to the birth of the Winchester drive.

Hard Disks Aren't So Hard

Let's look at the hard disk in detail.

The basic ingredient of the hard disk drive (Photo 1) is the platter, which, at 14 or eight inches, is a precision piece of aluminum. Remember, the hard disk has to rotate at about 3600 rpm with little or no side-to-side or up and down movement. A fine coat of oxide (about 440 microinches) is bonded to the aluminum platter, making up the storage medium.

Next, you've got to spin the disk. There are two predominant ways to do this (and again, much the same technology is used in high-quality record players). One way is to spin the disk with an ac motor, driving the disk spindle (the center shaft) with a belt. The second way is to make the spindle of the disk into a dc brushless spindle-drive motor. The ac motor and belt are cheaper; the dc brushless spindle-drive motor can be held to greater speed tolerances. The better you can regulate rotation speed, the less chance of losing data.

Now that we've got the disk, let's talk about getting information onto and off of the platter.

Readin' and Writin'

The first thing we should do is look at the way data is stored on a disk.

For the purposes of this discussion, we're going to use a totally inefficient disk, shown in Fig. 2. It's inefficient because this disk is going to have only ten tracks.

Now, the number of tracks that can be used on a disk is determined by how far you have to move the read/write head before you can continue recording data. In other words, the tracks can't be so close together that the head's magnetic field destroys information on the tracks to either side of the one you're recording on. Therefore, the number of tracks on a disk is

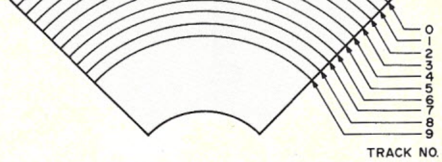

Fig. 2. This is an illustration of a portion of a simplified disk. Tracks are numbered from the outside toward the inside. Most minifloppies use 35 to 40 tracks.

determined by the intensity of the read/write head's magnetic field, and, to a smaller extent, how much control you have over the placement of the read/write head. The drawing in Fig. 2 is highly exaggerated, of course. The single-density 5.25-inch drive in my home computer has 40 tracks, spaced 0.02083 inches apart.

The read/write head is mounted on the end of an arm. The arm moves from the edge of the disk to the center of the disk in small, repeatable steps. Repeatable is the key word. You have to be able to put the head back onto the center of the track every time.

There are two primary methods (with variations) of moving the head to the proper location over the track: stepper motor and voice-coil actuator.

The stepper motor has been around for quite some time, and is usually implemented in one of two ways. The first is the lead screw method shown in Fig. 3. As the stepper motor increments its way in one direction or the other, it turns the lead screw, which moves the head in or out from the center of the disk. There's a third mechanism connected to the head carriage that forces the head up and away from the disk surface (unloading the head). Floppy disk drives let the head rest right on the disk during read or write. Hard disk drives, on the other hand, never (well, hardly ever) let the head touch the surface of the disk. More on that later.

Another method of using the stepper motor involves band actuators shown in Fig. 4. As the stepper motor rotates, the bands on the actuator push the head carriage to the center of the disk, or pull it away. Again, another mechanism serves to load and unload the head.

The chief limiting factor in using stepper motors is wear. As the motor wears, the step increments may change, and the head can't be positioned properly over the track. There's no feedback to the drive controller to tell it where the head's at. This is called an open-loop positioning method, and the reason stepper motor drives require periodic head alignment. How do you get around this? The voice-coil actuator.

The voice-coil actuator is a closed-loop system. That is, the controller always knows the position of the head. Without getting into detail, it works in this way.

First, no stepper motor is used to position the head. Instead, a linear motor is used. The linear motor can move the full length of its travel without stopping, or can move to any point along the way and stop. A comparison can be made between a pulse-jet engine (the stepper motor) and a constant thrust rocket (the linear motor). The stepper motor moves in small increments, or bursts, while the linear motor moves smoothly throughout its range.

When you use the stepper motor, you simply tell the motor to move n number of steps in one direction or another, and it's a fairly safe bet that the motor did just that. You can't tell that to a linear motor. The linear motor requires constant control and is made up of a cylindrical, permanent magnet, with a hole bored down through the center (see Fig. 5). Within this hole is placed a coil on a shaft. Attached to the shaft is the actuator arm carrying the read/write head.

So, how do you control the linear motor? With the disk!

Each track on the disk contains header, sync and data information, just as a stepper-motor-actuated disk does. In voice-coil-actuated drives, each track also contains servo information permanently impregnated on it by the disk manufacturer. As the voice-coil actuator moves the head across the disk, the servo information tells the controller where the head is, and the controller moves the actuator accordingly, closed-loop. With a stepper motor actuator, the drive control-

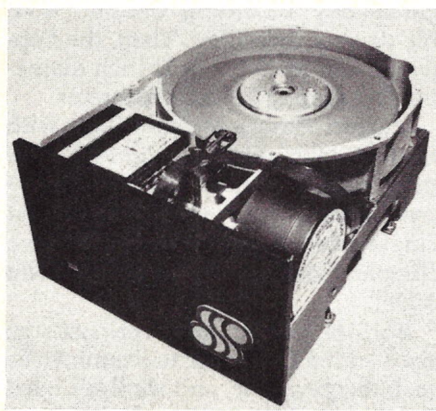

Photo 2. The first 5.25-inch Winchester Technology disk drive. This is Shugart Technology's ST500. (Photo courtesy Shugart Technology)

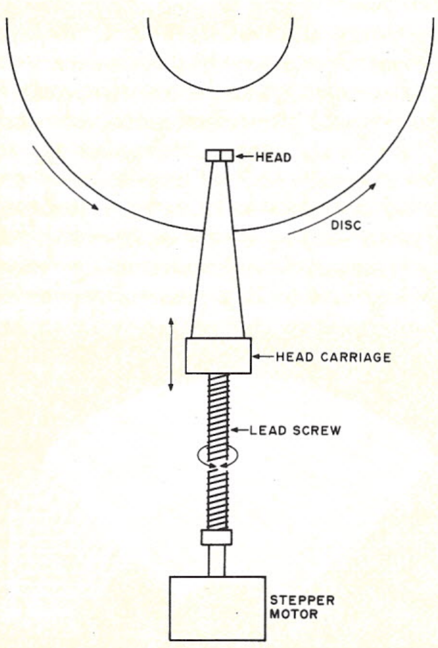

Fig. 3. The lead screw/stepper motor actuator. As the stepper motor turns, the lead screw pushes the head toward or away from the center of the disk.

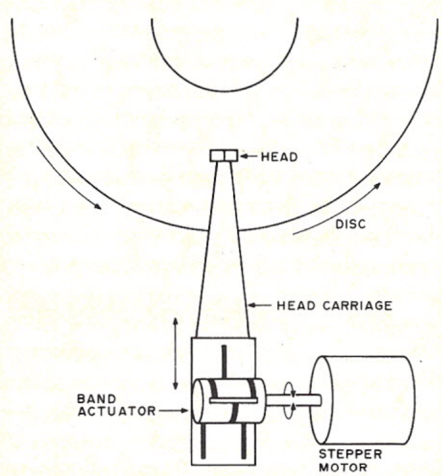

Fig. 4. The band actuator uses bands connected to the hub of the stepper motor to move the head carriage.

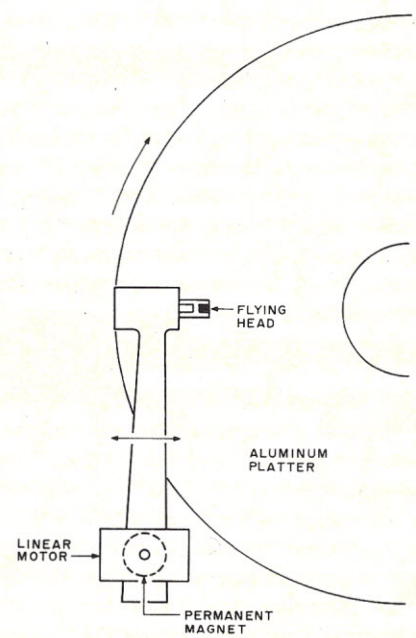

Fig. 5. The linear motor actuator. A moveable coil inside a fixed permanent magnet lets the arm move in a linear fashion.

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ler tells the motor where to move, and then takes it on blind faith that the head arrived. With the voice-coil actuator, the controller knows exactly where the head is.

Are there drawbacks to the voice-coil actuator? Of course. The biggest drawback is that each piece of track taken up by servo information is that much less track you can put information on. And, the servo information forces the disk to be hard-sectored (each track contains a set number of sectors, and each sector contains a set number of data bytes).

But these drawbacks are reduced because of the amount of information you can store on the disk (increased head positioning accuracy equals decreased track-to-track spacing). Don't expect your 5.25-inch floppies to use voice-coil actuators, because they simply use up too much valuable storage space.

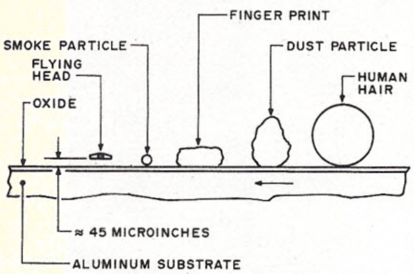

Fig. 6. This illustration shows the size relationships of a flying head and contaminants.

What have we got so far? Well, we've taken a brief glance at the development of the hard and floppy disks, and we've explored the various methods of moving a head back and forth on a disk. Next, let's look a little closer at the joining of the head and disk.

The Magnetic Interface

Let's go back and review the way the head is positioned on the disk. Remember that the floppy disk drive places its head right down on the disk. This is only possible because the disk is rotating at about 300 rpm. The rotation speed, plus the type of oxide and lubricant used, limits how fast you can retrieve information from a floppy disk.

The hard-disk drives are another story. To spin the disk at 3600 rpm (thus improving data access time), the head can't touch the disk. Instead, the head "flies" above the disk on a cushion of air. For you pilots, this is the ground effect. In common hard-disk technology, the flying head rests on its cushion of air about 45 micro-inches (1.4 microns) above the disk surface. For reference, a human hair is about 3 milli-inches in diameter. The distance, along with its built-in problems, is shown graphically in Fig. 6.

As you can see, almost anything is bigger than the gap between the flying head and the oxide surface of the disk. This is why you'll notice loud no smoking signs in computer rooms that contain hard-disk drives. And this is also why hard disks are transported in plastic containers. If a particle of almost anything contaminates the disk, it will undoubtedly cause what's known as a head crash. In other words, something on the disk bashed into the head. The resulting data loss can be mighty frustrating.

This brings us right back to the folks at IBM, who were sitting around trying to figure out how to get more information on a disk. As it turns out, if you can get the head even closer to the disk, you can store more information faster. Move the head closer, reduce the magnetic field, increase the number of tracks per disk. No doubt, someone said, "If we move the head closer, anything larger than a hydrogen atom will cause a head crash." "True," might have said another, "but what if we don't let anything touch the disk? What if we seal the whole thing up?" Thus was born Winchester Technology.

Back to Where We Were

If you were to take a regular hard-disk drive, adjust the head from a 45 micro-inch gap to about an 18 micro-inch gap, seal the whole drive in an airtight container, pump all the dirty air out and replace it with inert gas or filtered air, you'd have yourself a Winchester Technology disk drive. That's the whole thing in a nutshell. The mechanical part of a Winchester drive is about the same as a normal hard-disk drive. Except that you can't remove the disk. It's in there permanently, although some people are working on that, too.

So, hard-disk drives come in two categories: removable disk (normal drive) and fixed disk (Winchester drive).

What's so great about Winchester Technology? Well, you can store more information on the same size

disk, and you get better data access time. Sealing the whole thing up increases reliability. All of these are a definite plus.

Does it have any drawbacks? What doesn't? The term fixed disk is the key. At this writing, that disk is in there to stay. The only place a disk can be removed is in the manufacturer's clean room. This means that if the disk crashes, you can't pull it out and replace it with a backup. You have to bite the bullet and send the whole drive out for repair. For this reason, manufacturers are scrambling to come up with a way to back up information that is stored daily on the disk. Some methods involve:

- A dual disk drive: one Winchester and one removable.
- A Winchester backed up by a tape cartridge unit.
- Winchester-to-Winchester backup.

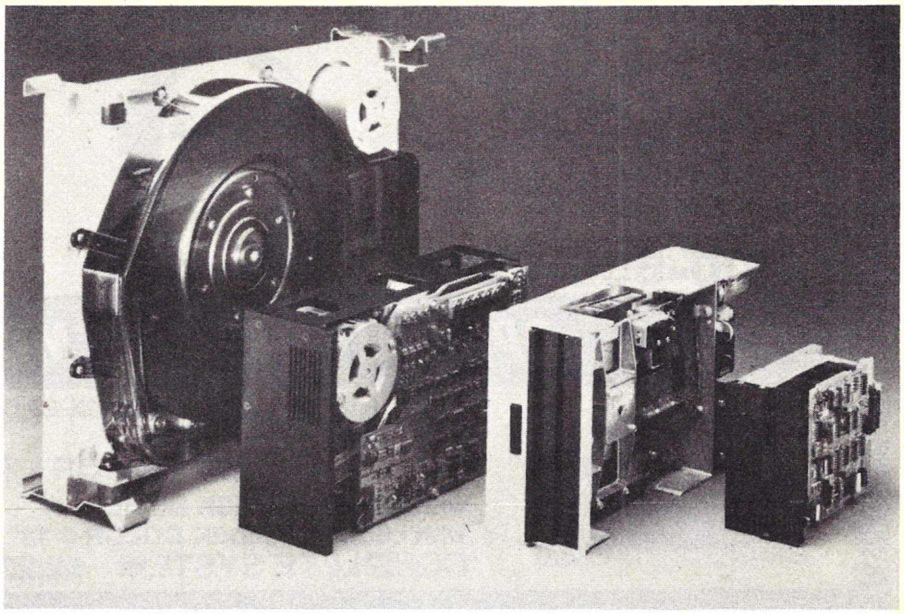

Photo 3. The full line of Shugart Associates disk drives, ranging from a 14-inch hard disk down to their 5.25-inch minifloppy. Shugart Associates plans a 5.25-inch Winchester of their own, to be called the SA500. (Photo courtesy of Shugart Associates)

At Last, the 5.25-inch Winchester

In the early 1970s, a gentleman by the name of Alan Shugart had a better idea. The eight-inch flexible disk drives had been around for a while, and Shugart decided they were too big and expensive. So he, along with a few cohorts, formed Shugart Associates, and invented the 5.25-inch minifloppy. The price tag was about half that of the eight-inch drive, and the market was ripe. His 5.25-inch drive brought high-speed mass storage to the small-computer owner.

Then, in 1975, Shugart turned over the reins of Shugart Associates, and went into consulting—until lately, that is. It seems Shugart had another better idea. He started another com-

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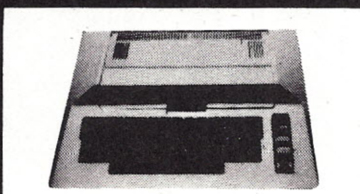

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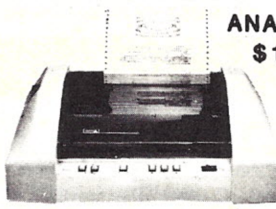

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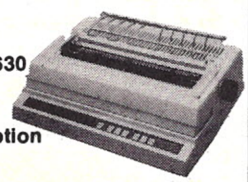

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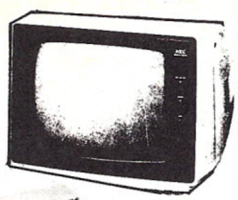

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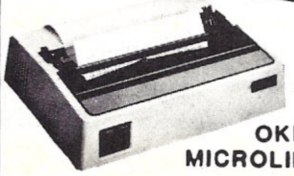

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Shugart Technology's ST500 series 5.25-inch Winchester disk drive system. (Photo courtesy Seagate Technology)

pany, this time called Shugart Technology, and designed a 5.25-inch Winchester disk drive. In May of 1980 his Winchester drive was introduced to the world at the National Computer Conference. Let's take a look at this little Winchester.

Shugart Technology's ST500 5.25-inch Winchester

What are its capabilities? Just for fun, let's compare the Shugart Technology Winchester drive with the 5.25-inch floppy drive in my home computer. My drive is listed on the left in Table 1, and is a ten-sector, single-density, single-sided, 40-track drive.

It's impressive, isn't it?

The Shugart Technology ST500 mini-Winchester contains two 5.25-inch disks and four heads. The ST500 uses a stepper motor with a band actuator to position the heads. The disks are driven by a brushless dc motor that spins the disks at 3600 rpm. The large storage space of the ST500 gives the drive about 15 times the capacity of a double-sided floppy at only three times the price.

The ST500 mini-Winchester uses 153 tracks on each side of its two disks. Track-to-track access time is three ms. Maximum track access time is less than one-half second, with the average time being 170 ms. The spindle drive motor controls the rotation speed of the disks to within ±1 percent. Finally, at shutdown, a brake stops the disks within 15 seconds.

The ST500 seals the dirty air out and filters its own air in a closed loop filtration system. Shugart Technology claims that the calculated mean-time-between-failure (MTBF) is 8000 hours of operation.

ST500 Interface

The ST500 uses a very simple interface scheme that closely resembles the interface to most common floppies:

- Four drive select lines
- Two head select lines
- Step control line
- Direction control line
- Track 00 indicator
- Seek complete indicator
- Index indicator
- Ready indicator
- Reduce write current control line
- Write gate control line
- Write fault indicator
- MFM write data line
- MFM read data line
- power (+12 V dc & +5 V dc)

The Bottom Line

What's the bottom line? Well, Shugart Technology is offering the ST500 for $925 in quantities of 500. The single unit price is about $1400. But not to worry. BASF and Control Data have both stated that they'll have 5.25-inch Winchesters available in early 1981. More good news is that Texas Instruments has decided to second-source the ST500. And, word has it that Shugart Associates is also going to market a 5.25-inch Winchester.

Shugart Technology is the only manufacturer right now, but as the others come on line, the price should drop. (Does anyone remember the HP-35 calculator and its original $395 price tag?) Western Digital is reported to be designing a controller that will handle two ST500 drives.

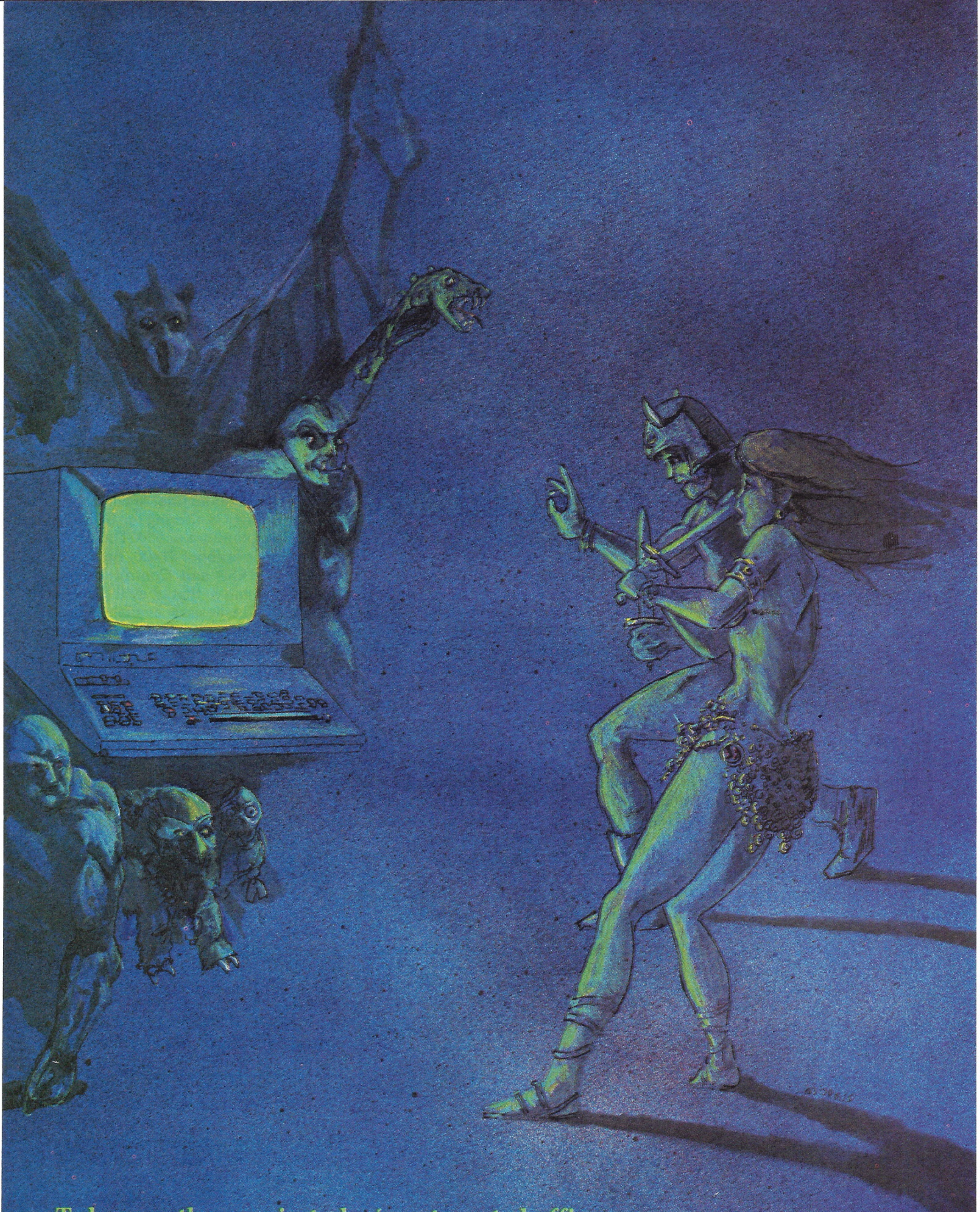
At any rate, you can expect to see a lot more 5.25-inch Winchester drives within the next few years. The drive is nearly perfect for low-cost applications in things like word processors and your home computer.

Should you buy one? I don't know. But I do know it will be well worth looking into. Keep your eyes open.■

	5.25-inch floppy	**ST500 5.25-inch Winchester**
Unformatted data capacity	109 Kbytes	6.38 Mbytes
Average access time	370 msec	170 msec
Data rate (bits/second)	140 Kb/s	5 Mb/s
Time to full rotation speed	1 second	15 seconds
Power required	+12 and −5	+12 and −5
Power consumption	14 watts	22 watts
Size	3.25×5.75×8	3.25×5.75×8

Table 1. Shugart Technology compared.

Shugart Technology, the manufacturer of the ST500 5.25-inch Winchester drive, has recently announced a name change. The company is now called Seagate Technology, 360 El Pueblo Road, Scotts Valley, CA 95066.



Tubes are the rage in today's automated office,
but many workers fear that there is more to a VDT than meets the eye.

Video Dis~~pl~~may Terminals

Are They Hazardous to Your Health?

By Eric Maloney
Microcomputing staff

Video display terminals have arrived with a vengeance. Some seven million workers use them each day, and that figure will reach ten million by the middle of the decade. An International Resource Development report says that one out of every three white collar desks will have a terminal by the end of the 80s. Another million or so are being used by microcomputerists for home and business applications.

But as is the wont of American culture, we have perhaps embraced this new technology without first studying all of the implications. Employers and manufacturers have suddenly been beset by workers who claim that VDTs are neither safe nor healthy. Operators, their unions and scientists now say that poorly designed terminals in an ill-conceived work place can cause a variety of physical problems, including visual impairment, stress, musculoskeletal problems, anxiety and fatigue. Others speculate that non-ionizing microwave radiation from the terminals might contribute to cataract development and birth defects.

"The technology has just become so widespread," says Alan Fischer, program director of the Michigan AFL-CIO's Safety and Health Program. "It definitely is the wave of the future. But as in so many other areas, the technology has become widely used before we really know the effects."

Workers have responded on a number of fronts. In 1977, two copy editors at *The New York Times* charged that their VDTs had caused cataracts, and took the case to arbitration. A year later, typists at the United Nations refused to work on word processors for fear of radiation. More recently, workers at Blue Shield of California went on strike over, among other things, VDT health issues. And in Canada, a government worker claimed that VDTs had caused cataracts which had resulted in her blindness, and took her case to the Workmen's Compensation Board.

The questions concern not just the possible effects VDTs might have on the user's body and mind. They also involve such larger issues as the relationship between the worker and his or her work, and the amount of control the worker has over his or her environment. The situation, as several people have pointed out, is similar to that which existed earlier in this century, when automation came to the factories. The new technology will certainly benefit the employer, but what about the employee?

To a degree, microcomputerists are on the fringes of the maelstrom. Those who use micros in the home have much more control over the work environment. But if the home computerist isn't careful, he can face the same problems as his office counterpart. And as more businessmen and educators use micros at their place of work, the problems inherent to any VDT will become more evident.

As VDTs once again prove, no burgeoning technology comes without a price. But some solutions do exist, if people will spend the time, effort and money to recognize them.

Microwave Madness

On Feb. 26, 1981, the New York Workers' Compensation Board ruled that a New York Telephone Company worker had died of exposure to microwave radiation. And though NYT has appealed the case to the Appellate Court of New York, the board's decision has far-reaching implications—it is the first time that an official body has recognized chronic exposure to microwave radiation as a cause of death.

According to the *Microwave News*, Sam Yannon worked with low-power radio transmitters on the 87th floor of the Empire State Building from 1954 to 1969. He started to get headaches in 1964, and by 1968 was experiencing fatigue, eye trouble, sleep problems, forgetfulness and clumsiness. By the time he died in 1974, Yannon weighed less than 70 pounds, and had lost almost all sight, memory, speech and motor coordination. Yannon was 62 years old.

The decision is sure to stimulate vigorous debate. The scientific community is a caldron of opinion and controversy, and has made no exception for microwaves. Does the proliferation of microwave-generating technology—broadcasting equipment, radar, VDTs, television sets and ovens, to name a few—threaten the health of the general public? Both sides have their outspoken advocates.

The text of the appeal decision provides a microcosm of the debate. On the one hand, says the text, Dr. Milton Zaret found that Yannon "suffered an extreme case of microwave or radiowave sickness which resulted ultimately in his death." On the other hand, Dr. Paul Tyler "stated that... he finds no relationship between claimant's microwave exposure and diseases found and that he disagrees with Dr. Zaret's diagnosis."

Another doctor concluded that Yannon died of Alzheimer's Disease (premature aging) and found "no material indicating a relationship between microwave exposure and Alzheimer's Disease or cataract formation or causal relationship between claimant's work and his disability or death."

The Board ultimately sided with Zaret; Yannon's wife, Nettie, received $29,000 in retroactive awards and a pension of $45 a week for life.

The lack of consensus is due largely to the fact that U.S. scientists haven't done enough research on the subject. Microwave radiation, which falls roughly between 10 MHz and 100 GHz in the electromagnetic spectrum, is nonionizing, which means that it does not alter the cell structure in living organisms. Most of the attention has been given to ionizing radiation, whose effects on life in the form of nuclear weapons is much more dramatic. (See sidebar "Ionizing Radiation and VDTs.")

The perspective of much of the American scientific community is captured nicely in an article titled "Tests of Microwave Radiation Produce No Adverse Effects on Primates," in the May 1981 issue of *Research Resources Reporter*. The article begins by reporting that 12 test monkeys showed "no harmful effects" after microwave exposure. Project director Dr. Robert McAfee is quoted as stating that "In people, cataract formation is the only well-documented injury caused by microwaves...."

Later, the author asserts that "while physical and mental stresses may occur during low-intensity radiation, these effects are transient and do not indicate permanent injury." The article further states that an experiment involving rats showed "minor changes in red and white blood-cell counts," but that these changes were "not considered significant."

And yet, while the article asserts that microwaves are harmless, it also admits that there are some areas in which scientists confess complete ignorance. For example, one test showed higher levels of sulfhydryls, which are "involved in the activities of various enzymes." The scientist who conducted the test says that "Not only the health significance but also the biochemical mechanism through which this occurs is not understood."

Dr. Leonard R. Solon, in an article in the *Bulletin of the Atomic Scientists*, takes a different approach. While he says that the studies so far have been "incomplete and inconclusive," he states that observed reactions in humans include subjective complaints, biochemical or hormonal imbalances and hematological changes. He also points out that animal research has shown central nervous system impairment, chromosomal and genetic anomalies, cellular changes, behavioral alterations, prenatal impairment of body and brain weight and blood-brain barrier alterations.

A growing number of scientists are

Ionizing Radiation and VDTs

By Dr. Gordon W. Wolfe

The term "radiation" these days produces almost a knee-jerk response of "danger!" in the uninformed layman. What most people fail to realize is that radiation can be harmful, benign or even helpful. Radiation is more than just fallout from nuclear bombs. Sunlight is radiation—so are the radio waves from your CB radio or local television station. What makes some radiation harmful, and other radiation not harmful?

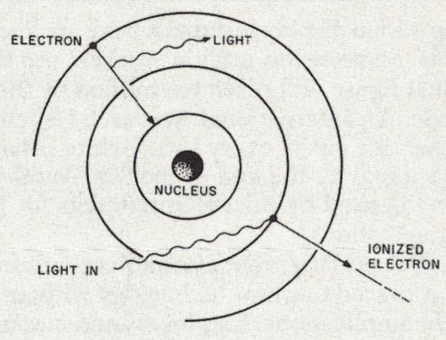


Fig. 1.

The key to understanding radiation is to understand its effects on matter. Matter as we know it is composed of atoms, which group together as molecules. Each atom consists of many heavy particles (called nucleons) grouped together in the center of the atom (called the nucleus), and a cloud of electrons in orbit around it (see Fig. 1). These electrons, according to quantum physics, can only occupy special positions, or orbits. They *cannot exist* between these special orbits.

When an electron jumps from a higher orbit to a lower one, it gives off light. This is the ultimate source of all light, which is a form of radiation. The process works in reverse, too. Light, or other radiation, can strike an electron, and cause it to jump from a lower orbit to a higher orbit. This process is called excitation. But the light has to have exactly the right amount of energy to cause the transition. It must have the same energy as the difference of the energies between the two orbits—too little and it can't make the jump; too much, and it would jump beyond the special orbit to a forbidden region.

If the radiation has enough energy, it can cause the electron to jump completely out of the atom. When this happens, the atom is ionized, and the radiation is called ionizing radiation. If an atom is excited, its chemical bonding properties (controlled by the

Address correspondence to Dr. Gordon W. Wolfe, Physics Department, University of Mississippi, University, MS 38677.

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willing to grant the possibility that microwaves in sufficient doses can contribute to the problems Solon mentions. But for the most part, they agree that the evidence is too flimsy to sound a general alarm.

The Soviet Union, on the other hand, has done much comprehensive microwave research, and their standards are stricter. Paul Brodeur, in his book *The Zapping of America*, says that the Russians have identified such problems as headaches, eye pain, stabbing pains in the heart, dizziness, irritability, emotional instability, depression, diminished intellectual capacity, partial loss of memory, loss of hair, hypochondria, loss of appetite, alterations in normal brain wave patterns, hallucinations, changes in cardiovascular functions, changes in blood pressure, changes in protein composition of blood, shifts in white-blood-cell counts, cataracts, increased thyroid activity, sterility and decreased lactation.

The Soviet Union sets a limit on microwave radiation of 10 microwatts per square centimeter, 1000 times lower than the U.S. standard of 10 mW/cm^2. They also discourage people with cardiovascular abnormalities from working in areas where they might be exposed to microwaves, prohibit microwave generators from areas where other work is being performed and require that antennas be directed to avoid irradiating people using them.

Brodeur suggests that the Soviet standards are stricter because of a greater understanding of what microwave radiation is. He says that U.S. scientists have focused almost entirely on thermal effects (those visible to anyone who has ever used a microwave oven) while ignoring possible nonthermal effects.

Solon agrees. "Not all investigators accept the validity of athermal biological effects," he says, "contending that such effects are attributable to microscopic heating." But if such effects are a reality, he says, they would be produced below 1 mW/cm^2, much lower than the current American standard.

Enter VDTs

There is no question that video display terminals emit low levels of nonionizing microwave radiation. The question is, how much? And even if the levels are below recognized safety standards, can we guarantee their safety, given the limited knowledge

(Continued from page 44.)

electrons) are changed. If an atom is ionized, it is no longer part of the molecule, and the chemistry of the molecule changes.

Radiation, then, if it has enough energy, can cause chemical changes in a substance. If the radiation has high enough energy, it can cause changes in the structure of the nucleus, and actually change the type of the atom from one element to another, although the probability of this happening is millions of times smaller than that of causing chemical changes.

In terms of affecting living tissue, we are speaking of changing the chemical structure of the living cell. Usually, in a living cell, the DNA pattern has the blueprint for the cell so that repairs can be made. If the DNA itself is slightly damaged, the RNA can usually repair it. Only when the DNA is heavily damaged, as in a massive dose of ionizing radiation, does the cell die or repair itself imperfectly. This latter case can lead to cancer.

Ionizing radiation comes in two forms: electromagnetic waves and charged particles. We have already seen how electromagnetic radiation (light, for example) works. Charged particles produce an electromagnetic field by their motion, which can also affect electrons. The faster (more energetic) the particle, the more electrons it can affect.

It all depends on the energy of the ionizing radiation. There must be sufficient energy in each particle of the radiation to ionize, or at least significantly excite, the electrons of the atoms.

This excitation or ionization energy is measured in electron volts, which is the amount of energy an electron picks up by falling through a potential difference of one volt. It is a very small amount of energy—only 1.6×10^{-19} joules (one joule acting in one second is one watt of power). It usually takes between one and ten electron volts to ionize an atom.

Table 1 shows the various types of electromagnetic waves, ranked in order of increasing frequency. This is the range of the electromagnetic spectrum. The only difference between light, radio and X-rays is the frequency of the wave. The numbers given are order-of-magnitude estimates for the center of the ranges.

As you can see, electromagnetic waves do not ionize matter until you get into the ultraviolet range, and it is only the high-energy ultraviolet, X-rays and gamma rays that can really be considered to be dangerous. Infrared and visible light can also affect molecular structure.

The dividing line between infrared and microwave is very vague. Microwaves (usually only those of very high frequency) can affect only inter- and intra-molecular vibrations and rotations. (Microwave ovens heat food by causing water molecules to vibrate in resonance to the radiation. This will only happen at one very precise frequency. No other frequency will affect water.) Radio waves, even VHF and UHF, have little effect on matter at the atomic level.

Charged particles are also ranked by their energies. Particles from accelerators or reactors are usually measured in millions of electron volts. X-ray machines make X-rays by accelerating electrons through hundreds of thousands of volts (giving them hundreds of thousands of electron volts of energy) and allowing them to stop suddenly on a tungsten anode, releasing much of their energy as X-rays.

(Continued on page 50.)

Wave type	Wavelength	Average energy (electron volts)	Effects on matter
Radio	1000m–10cm	0.0001	none at atomic level
Microwave	10cm–1mm	.01	fine, small molecular effects
Infrared	1mm–.001mm	.1	excites molecular structure
Visible light	7×10^{-4}m–3×10^{-4}m	1	excites electrons
Ultraviolet	10^{-4}m–10^{-7}m	10	ionizes outer electrons
X-rays	10^{-7}m–10^{-11}	1000	ionizes inner electrons
Gamma rays	10^{-12}m–10^{-15}m	10^6	excites nucleus

Table 1.

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"Employers are facing a different kind of concern, from pregnant workers afraid that VDTs might harm their unborn children."

of the scientific community?

The issues were first raised in 1977, when two editors at *The New York Times* developed cataracts. One was 28 and the other 35. They visited Dr. Milton Zaret, a Scarsdale doctor with a reputation for tilting at established ophthalmological windmills, who told the editors that their "bilateral incipient radiant-energy cataracts" were caused by microwave radiation from their video display terminals.

The National Institute for Occupational Safety and Health (NIOSH) took radiation measurements and determined that the VDTs posed no health problem. The arbitrator decided against the two editors. But the cataract reports continued to come in.

"We've had a fairly large number of cataracts," says David Eisen, director of research and information for The Newspaper Guild. "I'm talking about a dozen, which may not sound like a large number, but it is when you consider that it's happening to people in their 20s with no medical problems and no family history of cataracts."

Eisen says that the latest case involves a 25-year-old wire service reporter who has been working on VDTs for two years.

"But we've had people who've developed cataracts after only eight or nine months," he says.

The Guild serves some 32,000 members in the U.S. and Canada. Eisen estimates that perhaps 10,000 use VDTs.

"Certainly they're spreading; in the newsroom, of course, but also in circulation and advertising departments," he says.

Also recently, the Ontario, Canada, Workmen's Compensation Board ruled against a 40-year-old employee at the Ministry of Transportation and Communications, who worked on VDTs for 19 months before cataracts were discovered.

Most scientists agree that microwave radiation can cause cataracts. But, says the *Research Resources Reporter* article, the levels required are at least ten times the U.S. standard of 10 mW/cm², far higher than any measurements taken from VDTs. Zaret disagrees, claiming in a *Washington Post* article that he has seen over 100 cases of cataracts caused by radiation less than 10 mW/cm².

Many unions and employers are facing a different kind of concern, from pregnant workers who are afraid that VDTs might harm their unborn children. In mid-1980, a story broke that four former employees in the advertising department of the *Toronto Star*, all of whom had worked on VDTs, had given birth to children with congenital defects.

"The *Toronto Star* situation remains unexplained," says Gary Cwitco, health and safety officer for the Communications Workers of Canada (CWC). "While many officials and any number of scientists have said that the terminals were not responsible, they can't tell us what was."

Cwitco points out that the odds of such a high number of birth defects in one place at one time are "quite small."

"We have had a lot of colloquial reports which we've tried to follow up, but no clusters like at the *Star*," he says.

Alan Fischer says his union, too, has become concerned about the possible effects of VDTs on the fetus.

"Lots of union leaders have come to us with this problem," he says. "They have a member who's pregnant and using a VDT. Well, it's a scientific fact that radiation causes birth defects. But there's no conclusive evidence on low-level radiation. And there's no law saying that the employer has to take the woman off the VDT. So there's no place she can go to; she has to depend on the good graces of the employer."

Fischer won't speculate on whether VDTs are, in fact, a danger to pregnant women. "But if I were a pregnant worker—perhaps even if I were a male who was trying to impregnate my wife—I would try to get moved temporarily to another job."

The *Toronto Star* situation did cat-

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alyze one workers' action. Four pregnant workers at Bell of Canada participated in a work boycott this spring, expressing fear that their use of VDTs could harm their unborn children. The CWC argued to Bell that it was better to be on the safe side, and the company agreed. The four workers were allowed to take other work or ask for an early maternity leave.

"It's a significant decision for two reasons," says Cwitco. "First, it deals with a particular problem that our members are concerned about and gives them recourse. And second, it recognizes in the absence of definitive knowledge that we should take some action until the questions are answered."

Union health officials are showing a variety of responses to the radiation question. Some, like Fischer, feel that the focus on radiation might detract from other issues.

"Everyone is hung up on the radiation aspect of VDTs," he says. "The fact is that we're not going to find out about that for years to come."

David LaGrande of the Communications Workers of America (CWA), which numbers some 300,000 VDT operators among its 625,000 members, expresses similar sentiments. "We have not seen any evidence coming from the scientific community here—or in Europe, where the standards are much more stringent—which would cause us to believe that radiation emissions are a defined problem. That's not to say that no problem exists; until scientific testing, there *is* a possibility of significant emissions. But we're not really active in that area, except to suggest to the scientific community that they continue their testing."

Cwitco, on the other hand, does not believe that the radiation issue has been overplayed.

"An awful lot of people are running around saying that there's no radiation whatsoever, and that's simply not true," he says. "Any number of tests have been done that have shown very high readings. And each time the agency for one reason or another has said that the readings were spurious."

San Francisco Story

At the moment, the most well publicized study is one done by NIOSH in the Bay Area. Several unions asked NIOSH to investigate the San Francisco Newspaper Agency, the S.F. *Chronicle*, the S.F. *Examiner*, the Oakland *Tribune* and Blue Shield of California "to evaluate potential health hazards from the use of video display terminals. . . in information processing applications."

In each case, NIOSH reports that "exposure to x-ray, radio-frequency, ultraviolet and visible radiation was well below current occupational exposure standards, and, in many cases, below the detection capability of the survey instruments." The highest level found was 0.65 uW/cm², on an Ontel OP-1/64 terminal.

Another study, done by the Food and Drug Administration Bureau of Radiological Health and reported in the April 1981 *FDA Consumer*, concludes that "VDT's [sic] emit little or no harmful radiation under normal operating conditions; the emissions that are detectable are well below any existing national and international standards."

The article says that microwave emissions were "more than 100 times below the maximum level allowed under exposure guidelines set by the American National Standards Institute."

(The ANSI standard, though under reconsideration at press time, is 10 mW/cm²; thus, the FDA findings would be around 100 uW/cm², which, contrary to the previous quote, is ten times higher than the Soviet limits.)

(Continued from page 46.)

Whenever a charged particle is stopped quickly, it gives off radiation in the form of *bremsstrahlung*. The faster it was going or the quicker it stops, the more radiation it gives off.

What does all this have to do with video display terminals? The central fact is that video displays are a source of fast charged particles, and are a means of stopping them quickly. In Fig. 2 is a diagram of the CRT (cathode ray tube) display, which can either be an oscilloscope screen or a TV picture tube. At the far end is a source of electrons, which accelerates the electrons from a hot wire through a typical potential of 10,000 V. These accelerated electrons are deflected by a strong electric potential in an oscilloscope, or by a magnetic field in a television tube, to the screen of the CRT. The pattern of the beam deflection gives the characters and lines you see on the screen.

On the screen, they strike a phosphor and give off light. The pattern is repeated 30 times a second, retracing the whole figure, so you see a stable trace or picture. The deflecting voltages are small, and may be ignored for the purposes of this argument.

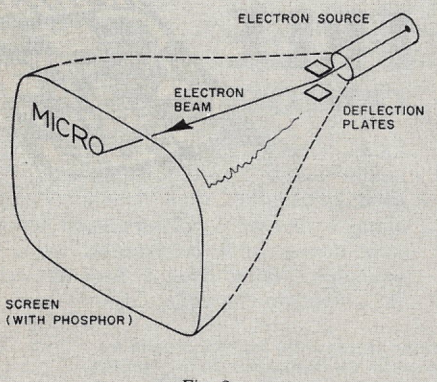

Fig. 2.

Notice that we have electrons (charged particles) with an energy of 10,000 electron volts. If this energy were converted to a single X-ray, it would be a very strong one indeed. Fortunately, two things prevent the user of a display terminal or TV from dying of radiation poisoning.

First, the probability of producing an X-ray is very small. It is much easier to simply ionize a few thousand atoms. The electrons thus released then jump back into their orbits, giving off thousands of harmless little bursts of light.

Second, if an X-ray is produced, that X-ray still has to go through the phosphor, the glass walls of the tube and several feet of air. Recall that an X-ray is ionizing radiation, and it will ionize every atom it comes into contact with. A glass tube is billions of atoms thick, and the X-ray will lose a few electron volts to every atom in its path. It never even makes it half way through the glass. It's much like trying to drive a car through a football stadium filled to the top bleachers with basketballs. (The simile is more representative if we make the stadium the size of New Mexico, and only put two gallons of gas in the car.)

It must be stated that I am speaking here only of the *immediate* effects of radiation. We are still learning about the long-term cumulative effects of small doses. But we all get a small dose (about 200 millirem per year) just from sunlight and our normal surroundings. ■

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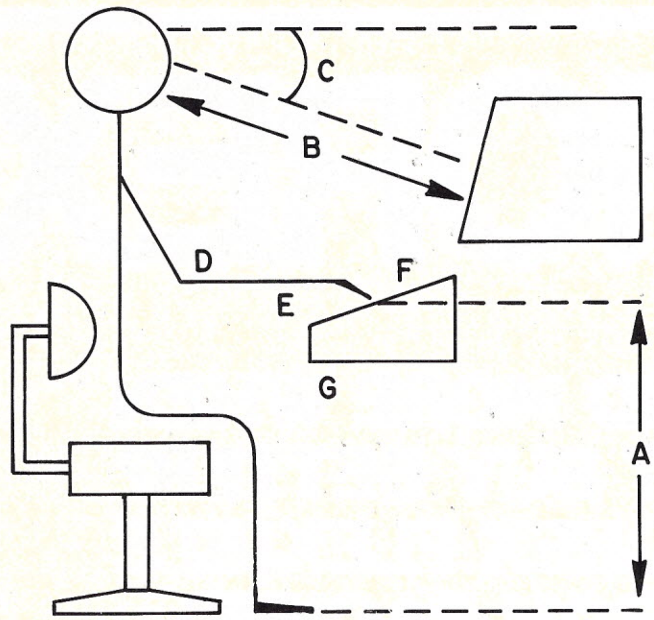

Fig. 1. These recommended work station specifications are taken from the National Institute for Occupational Safety and Health's San Francisco report:
a. The European recommendation for the height of the home row keys is 28-1/4 to 29-1/2 inches. The U.S. military standard is 29-1/4 to 31 inches.
b. The viewing distance should be between 17-1/4 and 19-3/4 inches, with a maximum of 27-1/2 inches.
c. Generally, the center of the screen should be at a position between 10 and 20 degrees below the horizontal plane at the operator's eye height. One researcher recommends that the top of the screen be below eye height, another that the top line of the display be 10–15 degrees below the horizontal with no portion of the screen at an angle greater than 40 degrees below the horizontal.
d. One researcher recommends that the angle between the upper and lower arms be between 80 and 120 degrees.
e. The angle of the wrist should be no greater than 10 degrees.
f. The keyboard should be at or below elbow height.
g. Don't forget enough room for your legs.

But these figures raise more questions than they answer. Measurements showed radiation below permissible levels, but are those levels low enough? Do we know for certain that there are no harmful long-term or athermal effects from low levels of microwave radiation? What does the FDA mean by "normal operating conditions"—can VDTs, like microwave ovens, become greater hazards as they deteriorate with age?

Louis Slesin, editor of the *Microwave News*, sums up the quandary: "Every time I think that the radiation effects are not serious, out comes another story that suggests there is a problem. Frankly, I haven't made up my mind yet."

Terminal Illness

In the long run, radiation might prove to be a significant health hazard to VDT operators. But in the meantime, a spate of other serious problems has captured the attention of users, unions and researchers.

The NIOSH study at Blue Shield of California, for example, reported a wide variety of health complaints among VDT operators. Some 90 percent said they had experienced pain or stiffness in the neck or shoulders during the last year, 89 percent reported headaches, 88 percent complained of back pain and 83 percent had endured periods of severe fatigue or exhaustion. Users also suffered myriad eye problems, including eyestrain (93 percent), tearing or itching (79 percent), burning (77 percent) and blurring (78 percent).

NIOSH considered any complaint reported by at least 50 percent of those surveyed to be a potential health problem. That figure was met in 35 of 59 areas.

Physical problems such as those found at Blue Shield paint only part of the picture. Many VDT operators are undergoing a great deal of psychological and mental stress. This is true particularly with clerical and secretarial positions. According to the NIOSH report, "Operators reported higher levels of anxiety, depression, anger and confusion," as well as irritability and tension.

The factors that contribute to both psychological and physical problems are many and complex. The study of these factors, and how they can be minimized to create a healthier and more productive work environment, is called ergonomics (from the Greek roots *ergon*, work, and *nemein*, to manage). Ergonomic research can be roughly broken down into two major areas: the work place design and management, and equipment design.

The work-place environment is perhaps the more important of the two. As Harold Snyder, president of the Human Factors Society and professor at Virginia Polytechnic, emphasizes, "No matter how good you design a piece of equipment, if you mount it in a poorly designed work place, you're going to have problems."

A prime concern of VDT operators and their unions is that employers are placing production considerations ahead of the operator's sense of purpose. By putting its workers in front of terminals eight hours a day and establishing strict production quotas, the employer turns the VDT into what Fischer calls "an assembly-line boob tube."

Gwen Wells, research director at the Office and Professional Employees Union (OPEU), likens the rise of the automated office to the rise of factory automation in the 30s.

"Today, offices are becoming like factories," she says. "Those things that make office work appealing just aren't there anymore. Workers don't have the same kind of involvement and interpersonal relationships. There's no opportunity to gain advanced skills to be promoted. People see it as a dead end."

David LaGrande echoes Wells' sentiments:

"Their job is being made much simpler on the one hand, but job stress problems enter the picture. Surveys by the Newspaper Guild show that for many of its members, the VDT is a positive change. I think we would see it that way as well.

"But clerical workers have very little work-space control. The pacing is determined by machines. It's almost a factory-like situation."

The problems caused by the kind of work being done are often aggra-

vated by the physical conditions under which the VDT operator must function. Many offices have poor lighting. Work stations are often positioned so that VDTs reflect glare from windows and lights. Light-colored, high-reflectance surfaces can raise illumination levels, and can also cause eyestrain as the operator glances from a dark video screen to a bright background.

> "Manufacturers can call anything an antiglare filter and meet the union's requirements when in fact they are creating more eyestrain."

The work-station design is a source of many problems. Excessive keyboard height can lead to muscle fatigue. Improper viewing distance and angle of vision can force the operator into awkward and stressful positions. Solving one problem will often create another—lower the keyboard, and, if the keyboard is not detachable, you also lower the terminal. Finding the proper balance isn't always as easy as it sounds (see Fig. 1).

By itself, a poor working environment is difficult for workers to overcome. Throw in improperly designed equipment, and the problems multiply dramatically. And such equipment has, to this point, been the rule rather than the exception.

Start with the video display. A major complaint of users has been excessive glare. This comes from a variety of sources, including lights and windows, the clothing of the operator and objects behind him or her. The user must not only squint to see the image, but must also continually refocus as his or her eye moves from the reflection to the display. The result is a great deal of eyestrain.

There are several ways to cut down on glare, says NIOSH researcher Dr. Marvin Dainoff. Unfortunately, he adds, manufacturers often choose an inexpensive method, which can create as many problems as it solves. Smoked plexiglass and etched glass will both reduce glare, he says, but they also degrade the image.

"You can achieve the same thing with a pair of sunglasses," he says.

Mark Parish of Optical Coating Laboratory, which markets several nonglare panels, concurs.

"The eye is essentially a servo mechanism," he says. "It searches for an image until it locks onto what the mind wants it to. With an unfocused image, the eye simply won't lock on."

Parish adds: "The unfortunate thing is that they [the manufacturers] can call anything an antiglare filter and meet the unions' requirements when in fact they are creating more eyestrain."

The color of the screen can also be a factor, although what color is best is still subject to debate.

"There are a number of different recommendations, and they're usually contradictory," says Dainoff. "A couple of studies from Europe indicate that green is a little better than

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black and white, that yellow is a little better than green. But the difference is probably too small to be important."

Synder prefers black on white "because the glare problem is effectively eliminated. Also, the eye is operating at a much more efficient range because it is adapted to a higher luminescence level."

Keyboards, too, have caused problems for operators. If the keyboard is too thick, the operator might have to raise his or her arms to a less comfortable position. If the keyboard is not detachable, the operator again faces problems trying to place him- or herself properly in relation to the keyboard and terminal.

Researchers also point out that people vary in body size and proportion; a single standard station isn't possible. The keyboard and terminal heights might be perfect for one person and unacceptable for another.

Finally, manufacturers and employers often don't recognize that some people have specific problems that must be addressed. Dainoff points out, for instance, that people over age 45 get presbyopia—a loss of elasticity in the eye that causes an inability to focus on nearby objects—and must wear bifocals. If the terminal is not adjusted properly, the person must strain his or her neck to look through the bottom part of the lenses. This can cause serious musculoskeletal problems.

As workers and their unions become more vocal about these conditions, they turn to the bargaining table for possible solutions. And this raises another, this time political, issue: how much input should the worker have in the design and function of the work place?

Employers often argue that concessions to union demands will reduce efficiency. But, says LaGrande, this is not the real reason for their reticence.

"I think it primarily has to do with how much control workers have over the work place," he says. "If workers get something like rest breaks, they've established an awful lot of control."

This control is being demanded by workers who've traditionally been on the periphery of the labor movement—clerical workers, typesetters and the like. These people have often been too fearful of losing their jobs to complain about poor working conditions.

Employers aren't going to give in without a struggle. Thus, unions will often receive only partial concessions to contract demands.

But as Dr. Steven Sauter, a psychologist with the University of Wisconsin's Department of Preventive Medicine, points out, "It is absolutely mandatory that anyone thinking about installing VDTs consider the human engineering factors. Otherwise, they're guaranteed to have problems down the road, even under the best of circumstances."

And this usually means lending a sympathetic ear to the complaints and suggestions of employees.

Some Solutions

Everyone agrees that solutions exist. But they depend on two key factors.

First, employers must be willing to recognize the advantages of proper working conditions, and must be willing to spend some money to provide them.

Second, manufacturers must provide well-designed equipment.

Is management responding? The answer is a qualified "yes."

"Management by and large tends to play down the seriousness of the problem," says David Eisen. "At every stage of the game they've tended to say that there is no problem, or it is a little problem, or that the problem is being solved, or some variation of that argument. Their position is that little or nothing needs to be done.

"I suppose it's understandable if you take a narrow, self-interest point of view. VDTs are critical to their operation; they modernize production, they increase productivity immensely. Anything that threatens them is going to get a knee-jerk reaction."

"Some have been responsive," says Gwen Wells. "But when they put a machine in the office, they put them there to increase production, and that's what they're concerned

Tips for VDT Users

The National Institute for Occupational Safety and Health indicates in its San Francisco study that a number of steps can be taken to minimize ergonomic problems in the office. Many of their recommendations can also easily apply to the home work environment.

☐Operator chairs should be adjustable in height and have back rests. Back rests should be adjustable to the lumbar region (mid-back).

☐Work stations should have a place for operators to rest their wrists and forearms. Armrests should be removeable.

☐Keyboard height, screen height and position should be independently adjustable.

☐The operator should be able to adjust screen brightness and contrast.

☐Lighting levels should be between 500–700 lux, depending on visual demands of other tasks performed in the work area.

☐Glare control should be a prime consideration, and can be done with a combination of a number of methods, including:

- Drapes, shades and blinds on the windows,
- Proper positioning of terminals with respect to windows and overhead lighting,
- Screen hoods,
- Antiglare filters on the VDT screen,
- Recessed, covered or baffled direct lighting fixtures and
- Indirect lighting fixtures.

Also, the NIOSH report recommended 15-minute work-rest breaks after two hours of continuous VDT work for operators under moderate visual demands and a moderate work load, and a 15-minute break after one hour of continuous VDT work for operators under high visual demands, high work load or for those engaged in repetitive work tasks.

Finally, the report said that there is a need for mandatory vision testing.

"It is recommended that . . . at the very least VDT workers should have a comprehensive pre-placement vision examination, the report says. "We also recommend that those individuals who become symptomatic even after the initial exam should receive appropriate medical care and that a general exam should be repeated periodically."■

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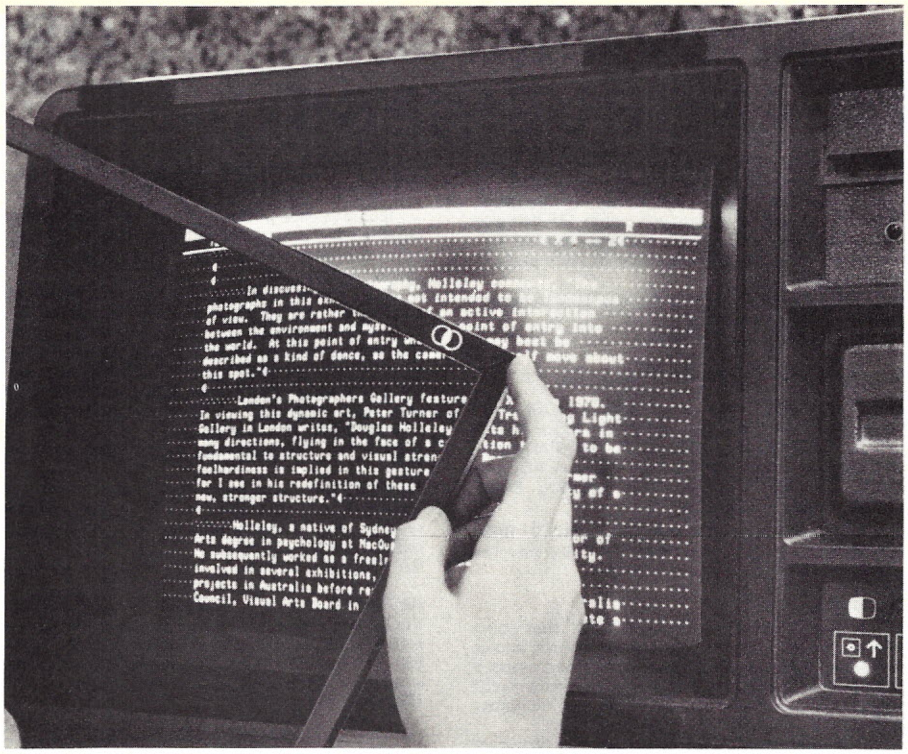


Polaroid's CP-70 Contrast Enhancement Filter uses a circular polarizer which the company says improves the contrast of VDT screen displays while eliminating reflections and glare. The glass version is available for 10-, 12- and 15-inch tubes, with prices ranging from $68–$98.

about. So you can talk about rest breaks, but they want their machines running full-time. Otherwise they lose money.''

Blue Shield is a good case study. The company refused to recognize NIOSH's findings even before the final version of its report was issued. Last December, some 1100 Blue Shield employees, all members of the OPEU No. 3, went on strike. Money was one of the issues, but VDT safety was also an important demand.

Blue Shield spokesmen told the press during the strike that the VDT issue was ''blown out of proportion.'' They also said that the company had voluntarily made several ergonomic changes, including window curtains to cut down on glare, terminal hoods, dimmer switches for the overhead lighting and keyboard changes.

But the OPEU wanted the concessions in writing. And when the strike ended 19 weeks later, the company had signed a letter of agreement promising adjustable chairs, specially designed work desks, foot rests, proper lighting conditions and instructional material on proper VDT use.

Significantly, the union did not receive its demand for hourly rest breaks, which many researchers and union officials see as essential.

Blue Shield is an example of a company that had to deal with ergonomic problems after the terminals had already been installed. Retroactively providing such features as detachable keyboards, adjustable terminals and nonglare screens can cost a lot of money. A company will invest, for example, $100 in a terminal, and discover that a nonglare shield will cost another $75.

Naturally, unions would like to see employers install the proper equipment right from the start. ''The whole occupational safety and health movement in labor is aimed at prevention,'' says Fischer. But again, companies might find it too expensive, and opt for what LaGrande calls a ''human relations approach.''

''The human relations approach is where they let employees voice their complaints, but don't do anything about the problem,'' he says.

The Newspaper Guild has been more active than most, bargaining for ergonomic concessions in the newsroom. As a result, an increasing number of newspaper employers are addressing VDT-related problems. At least 17 newspapers now pay for employees' first or subsequent eye exams, while at least seven pay for new or improved eyeglass prescriptions. The newspapers in Minneapolis and St. Paul, MN, provide extra rest periods.

VDTs were one of the central issues in recent negotiations with Bay Area newspapers, says David Eisen. Those negotiations were completed before a strike occurred, he says, but adds, ''If a strike had come, it [ergonomics] would have been one of the issues.''

While the Guild did not win paid ophthalmological exams, they did get adjustable chairs, footrests, adjustable VDT height, suitable lighting, glare shields where requested, detachable keyboards where practical and feasible, and brightness control for a specific VDT model widely used. Employees will also have their new eyeglasses paid for.

Manufacturers present yet another obstacle. Fischer contacted several when he helped put together a conference on VDTs in Michigan last spring.

''You know what kind of answers I got?'' he says. '' 'Oh, we didn't know there was a problem.' It's a little bit disheartening. I'm disappointed in the manufacturers, that they're not taking human engineering into consideration.''

Harold Snyder points out that, again, the bottom line is money.

''That business is awfully competitive, and it's in the same mode as the auto industry: how do we make it cosmetically appealing but cheap to manufacture? They haven't put in any seat belts; they're going for the sex appeal.''

But there are some signs of change, at least among the large mainframe manufacturers. Dainoff says that in one survey, about 25 percent of mainframe computer companies mention ergonomic features in their magazine ads.

''The mainframe manufacturers are at least mentioning the words human factor and ergonomics. At least they're using the buzz-words.''

At least two companies, says Dainoff, are marketing highly sophisticated nonglare shields: OCLI and Polaroid. Their shields, he says, cut down reflective glare while enhancing the contrast. OCLI sells mainly to terminal manufacturers, and their shields cost $10–$30 in quantity. Polaroid sells their shields in a number of sizes in the retail market, with prices ranging from $68–$98.

A quick scan of new product releases shows varying degrees of awareness on the part of manufactur-

ers. One brochure for an office furniture company, for example, shows a picture of a typist with her elbows almost in her lap. On the other hand, Cortron is promoting a keyboard which it says in the first paragraph includes a new low-profile design which "meets the new European ergonomic requirements."

One particularly eye-catching release, from California Computer Systems, is for the Ampex Dialogue 30 and Dialogue 80 VDTs. Both terminals include nonglare screens and detachable keyboards, and, says a CCS spokesperson, will soon offer amber screens. The spokesperson says that such features are in response to requests from potential customers.

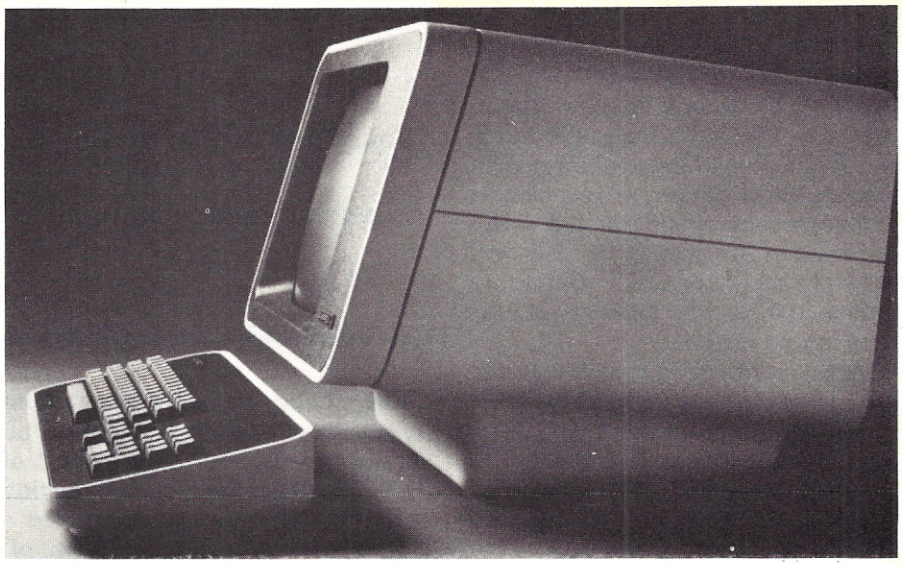
"Everybody asks for a detachable keyboard," she says. "It has become a determining factor for people when buying terminals."

Naturally, the Ampex VDTs don't come cheap: the 30 costs $995, and the 80, $1245.

Stuart Bennett, manager of the Polarizer Division of Polaroid, sums up the manufacturers' responsibilities:

"A year ago, they didn't feel that it was their problem. Today they're beginning to feel that it is. That problem's extent is well-known at this point. You can't find anybody with terminals in his office who doesn't have operators complaining about eye fatigue and visual problems.

"The manufacturers are beginning to realize that they're going to have to do something about it."



The Ampex Dialogue 30 and 80 video display terminals offer several ergonomic features, including nonglare screens, detachable keyboards and amber screens. Some researchers think that amber is easier on the eyes than green or black.

More Union Activity

Employers are bound to see an increase in union activity over the next few years. Already, many unions are

mobilizing their resources. In Michigan, some 200 delegates from 14 different unions met on April 13 to discuss possible standards to be administered by the state's Bureau of Safety and Regulations. The goal, says Alan Fischer, is to devise "a responsible and reasonable standard that won't overburden the employer but will protect the worker." Canadian unions, too, will be meeting, in Toronto in mid-October.

Some union people say that the VDT issue will also serve to raise the consciousness of workers who heretofore have not been organized.

"VDTs may be a key organizing tool," says LaGrande. "It may be a way to get a foot in the door. That clerical work force hasn't had much political impact in labor one way or another. It may suddenly become more politically conscious of what power it could wield."

Management is not entirely unaware of the potential. For example, a June conference sponsored by the International Word Processing Association included a presentation on "how to deal with unions when and if they begin to organize office workers."

> "Equipment used in the home—that stuff is still in the Neanderthal Age."

Meanwhile, the research community continues to do its work. The University of Wisconsin Department of Preventive Medicine, in conjunction with NIOSH, recently completed a large-scale survey of government office employees in that state. The findings, which confirmed the problems mentioned in previous studies, were read at the American Industrial Hygiene Association in May. Lab work continues at NIOSH's motivation and stress research section in Cincinnati, OH, and at Virginia Polytechnic.

The Visual Science Foundation in Palo Alto, CA, is cosponsoring with Stanford Research Institute a conference on VDTs this September. The National Research Council of the National Academy of Sciences is conducting a workshop in August.

A major study by the Newspaper Guild and the Mount Sinai School of Health will survey some 3000 employees in a half-dozen locals for health problems. The study will cover all departments, including editorial, advertising and circulation.

Finally, concerned parties are exploring the possibilities of legislation. Maine became the first state in the country in which legislators considered a bill to make certain VDT health and safety measures points of law. The bill, which was defeated in May, concerned employees who worked on VDTs at least four hours a day. It would have required employers to provide annual eye exams, semiannual maintenance of equipment, a rest period or a change of tasks every two hours and literature on proper VDT use.

The bill was sponsored by Edith Beaulieu, a representative from Portland. She works as a cleaning woman at a Portland newspaper, and is a shop steward for the Newspaper Guild. She had followed the VDT controversy through union material for several years, and decided to introduce the bill when she became the chairperson of the Legislature's Labor Committee.

Beaulieu says that opposition to the bill came primarily from industry, particularly banking and insurance.

"What fascinates me," she says, "is that none of them had heard of this when the bill came out. Six weeks later, they were all experts."

Beaulieu says there is "absolute evidence" that VDTs affect vision.

"I contend that the industry is going to be a lot happier with this kind of bill than they will be when someone with sore eyes pushes the wrong key on a computer somewhere."

What about Microcomputers?

At first glance, microcomputerists don't appear to be in the same boat as office VDT users.

"The users you're talking about are generally highly motivated, high-level, well-trained individuals," says Sauter. "The work they're doing is more creative. So I think that the problems we're seeing right now in the office will not exist in the home.

"In the office, you're talking about a fast pace, routine work, no control at all of the work place, no dedication to or personal interest in or under-

standing of what they're doing. At home, it's a different approach. A user can live with the inconveniences for short periods of time."

Dainoff points to European and New Zealand studies which indicate that programmers are the least likely of all VDT workers to complain.

"It's the structure of the job; it's challenging work," he says. "Also, the programmer is not locked into his terminal. He has other stresses, but they're primarily intellectual."

On the other hand, microcomputers are being used in increasing numbers in offices and schools. And in these environments, users are likely to find themselves subject to the same problems as other VDT users. In fact, because microcomputer manufacturers have been subject to less pressure from customers, who generally are not associated with organized labor groups, many micros will probably create more problems.

"Manufacturers are feeling the pressure right now," says Sauter. "With respect to human engineering, they're adapting. But equipment used at home—that stuff is still in the Neanderthal Age."

Dainoff says that there is "absolutely no data" on microcomputers and ergonomics.

"However, my own lab is using Apples, because it's cheaper to buy three of those than to buy a conventional minisystem. And I'm using one as a word processor, so I've got some personal experience with home computers. My feeling is that ergonomically, they're lousy."

Harold Snyder says that some of the worst displays he's seen are on terminals used with home computers.

"I've seen one terminal on a lesser-known [than Apple] microcomputer which you'd have to be eight feet away from to see properly," he says.

Problems exist in almost every area. Many microcomputers, for example, do not include detachable or moveable keyboards. The keys often are poorly spaced, do not offer a response when pressed and are not in a standard typewriter configuration. Few terminals are angle-adjustable, or have proper nonglare features. The display images are often poor, especially when a televison set is used as a monitor.

Microcomputer manufacturers show varying degrees of consciousness when discussing ergonomics. A spokesperson for Texas Instruments, for example, admits that the TI 99/4 is

"People will overlook some of the problems.
But sooner or later, home users will want better design."

"sort of lousy" for business applications, but says that the keyboard was designed "to accommodate youngsters." He says that the 28-column screen is designed to take advantage of the computer's graphics capabilities, which makes it difficult to use with a program like VisiCalc, which is best used with an 80-column format.

A person at Radio Shack admits that some people have opted for the TRS-80 Model II over the Model III because the former has a moveable keyboard. But he was skeptical of most ergonomic concerns.

"It used to be a big problem that there was no software," he says. "Now we've got software for the machines, so people start nit-picking. Once the major points are taken care of, they start looking for the minor points."

B. J. Freeman, an engineering liaison at Exidy Systems, says that ergonomics is a frequent topic of conversation among engineers. He indicates that the problem lies not only with the manufacturers, but with the expectations of the consumer.

"I've built display units for games and I've found that there is a high attraction for sound and color," he says. "If it has bells and lights and whistles, people think it's tremendous. If you show the same display on a black and white terminal, people think it's terrible."

So what's a microcomputerist to do?

If you're already using one, either at home or in the office, the same guidelines apply as with any other VDT. (See sidebar, "Tips for VDT Users.") If you're thinking of buying one, keep an eye out for a few simple features:

- The keyboard should be detachable or moveable. This will let you adapt the keyboard and terminal to your needs, rather than the other way around.
- Be sure that the keyboard is comfortable. Is the pressure to your liking? The spacing between keys? Do the keys let you know when you've hit them?
- Try to get a terminal with a good nonglare shield. The two best ones are made by OCLI and Polaroid, but, while OCLI indicated that it was negotiating with Apple and Radio Shack, most microcomputer terminals use less-efficient methods.
- Be sure that you can adjust the brightness and contrast.
- Check the image on the screen. It should be sharp and legible, with no flicker.

Eventually, microcomputer manufacturers will begin to incorporate ergonomic features into their equipment. The question, as Dainoff points out, concerns when the consumer will start demanding such features.

"People are so excited about microcomputers, and so impressed by their capabilities, that they'll overlook some of the problems," he says. "But I would guess that sooner or later, home users will want better design."■

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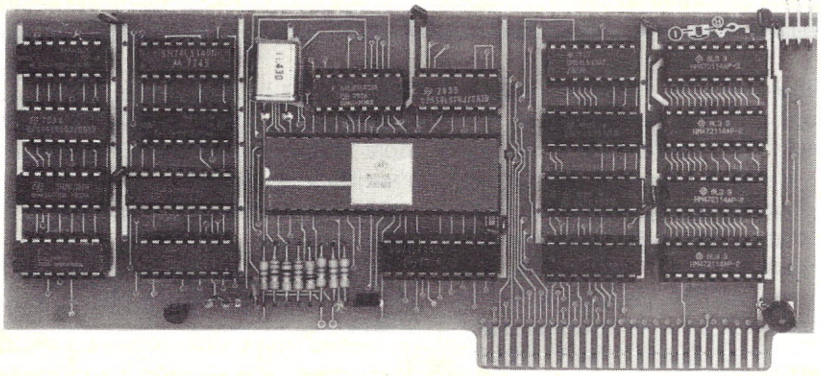

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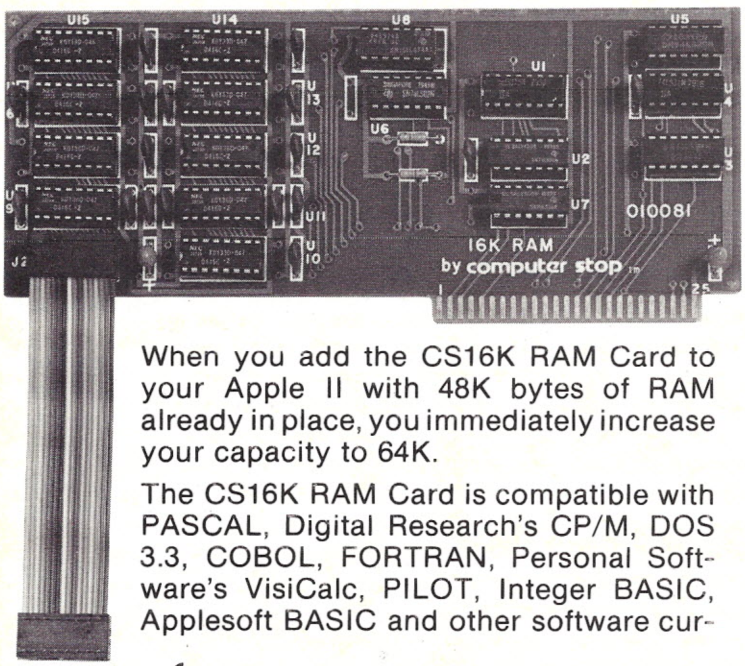

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With fixed 5 V and variable ±22 V output (at 1.5 amps), this supply can serve as an S-100 board test fixture or can power a small computer system.

Construct a Modular, Multi-Purpose Power Supply

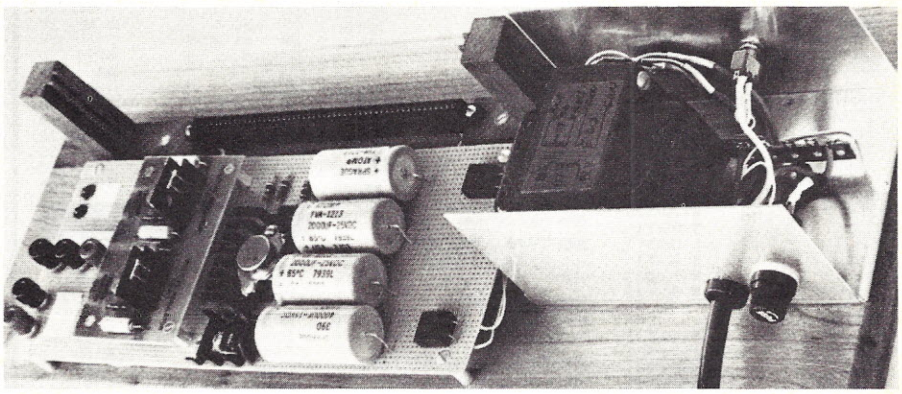
By J. C. Hassall

It was only a few years ago that the prospect of having to design a new power supply brought involuntary shudders from all but the most stout-hearted. Armed with a pad of paper, a large wastepaper basket, a slide rule (well, maybe it has been longer than I realize) and a dog-eared copy of ARRL's *Radio Amateur's Handbook*, you set out to design a choke input Pi filter (or was it a capacitor input?) supply.

Well, thanks to the folks that brought us the digital revolution, power supply design is now almost trivial. Fortunately, there are more "standard" voltage requirements for digital work than for ham radio work. If you are working solely with TTL packages, all you need is 5 V, so a 6 V lantern battery and a medium-duty diode (for a .7 V drop) will suffice. If you work with dual supply operational amplifiers, you need plus and minus voltages, say ±12 V. Or you might want a larger spread in voltages, say to ±20 V. If you work with RS-232C signal levels, you will need ±12 V, in addition to +5 V. The list could go on.

The present power supply design has evolved through a number of iterations to the present configuration. The intent was to provide a 5 V, 1.5 amp supply, all necessary S-100 voltages and two variable supplies to ±22 V at 1.5 amps. The power supply would thus fulfill a number of functions: the 5 V, 1.5 A supply would be ample for most TTL breadboarding; the S-100 voltages would allow testing of S-100 boards out of the system; and the variable voltage supplies would provide voltages for op-amp experimentation, RS-232 voltage levels for interface experimentation, voltages for A/D and D/A converter

Address correspondence to J. C. Hassall, H&H Enterprises, 1201 Highland Circle, Blacksburg, VA 24060.



An interior view of the enclosure, showing safety precautions used. The MOV (see text) is just visible under the switch leads.

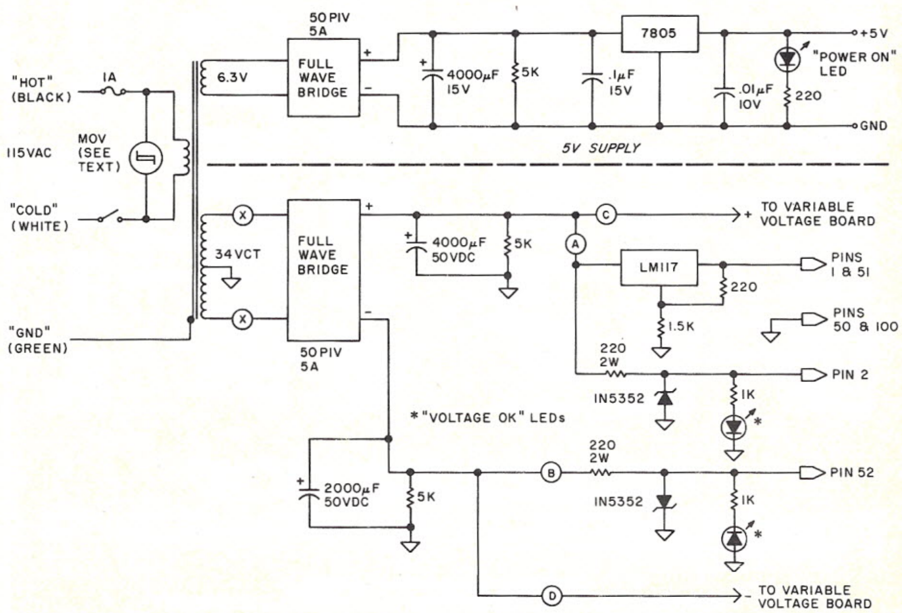


Fig. 1. Circuit diagram of the main system. See text for explanation of symbols. Unless otherwise noted, all resistors are ¼ W.

work and as many other uses as your imagination could provide. The power supply described here is powerful enough to power a small computer system, a single-board computer or all but the most power-hungry experiments.

The Finished Product

The entire supply fits easily on a 20×8 inch board. The power supply could have been packaged into a smaller area, but when area is available, I prefer to separate components to facilitate heat dissipation—you will notice that all regulators have heat sinks. Also, the empty space on the base allows the addition of breadboard circuitry on the power supply board. The S-100 edge connector allows you to directly check the board—no clip leads are needed.

Safety

One subject of concern to any power supply designer is safety. You will notice in the photo that all connections to the ac line are enclosed in the metal box. Hence, no idle fingers can contact line voltage. For the line connection, use a three-conductor cord.

As shown in Fig. 1, the fuse is installed on the "hot" side of the line, and the switch is connected in the "cold" side. By connecting the switch as shown in Fig. 1, with the cold side of the ac line going to one pole of the switch, rather than the center pole (or "toggle"), the remaining pole (if you use an SPDT switch) does not need insulation sleeving, as shown in the photo. Also notice in the photo the judicious use of shrink sleeving with all leads in the enclosure—another safety precaution.

By electrical code, the hot side is always color-coded black, the cold side is always color-coded white, and the ground lead is always color-coded

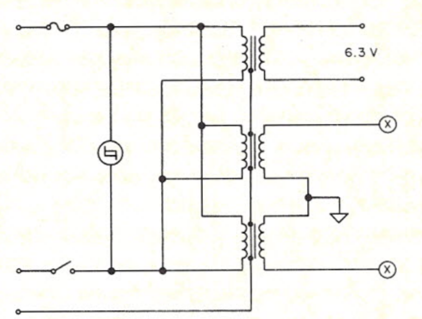


Fig. 2. A method of wiring multiple transformers to achieve the desired voltage if a standard transformer is not available. Points X-X correspond to X-X in Fig. 1.

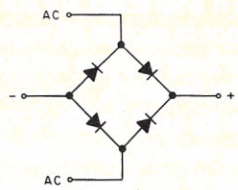


Fig. 3. Forming a full-wave bridge from discrete diodes. Each diode should be rated no less than 50 PIV, 5 A.

green. Use a terminal strip for all line connections—never use splices that are allowed to lie loose in the box.

A strain relief should be used on the line cord—either a commercial wire bushing or a knot tied in the cord—to prevent an accidental tug on the cord from pulling all the connections loose. Also, don't eliminate the line cord fuse, even though the secondaries cannot draw enough power to blow the fuse—safety again, if a short should develop in the transformer primary circuit. Use common sense and good electrical construction practices, and your power supply will be perfectly safe.

The Design

Referring to Fig. 1, you can see that the supply has been designed in a modular fashion. Sections can be eliminated or added later as desired. There are basically three modules: the +5 V supply, the S-100 taps and the variable voltage board.

The transformer I used had a multiple tap secondary, as shown in Fig. 1. However, if your junk box is not well-stocked, Fig. 2 shows how to arrange three transformers to create similar voltages. Radio Shack transformer 273-050 could be used for the 6.3 V supply, and two number 273-1512 transformers could be used for the higher voltages. Be sure to check out the transformer in the store, or ensure that you can return defective units—Radio Shack seems to have a quality-control problem with their transformers.

Regardless of what arrangement you use for the transformers, follow the safety precautions given above. Another practice I use is the MOV (metal oxide varistor) shown across the primary in Fig. 1. If your ac line has a lot of spikes (caused by motors cycling on/off, for example), the MOV helps to limit the voltage spikes.

In your application, the MOV might not be critical if you want to omit it. Bear in mind, however, that voltage spikes are potentially damaging. Spikes to 2000 V are not unusual on a standard 115 V ac line. Those spikes are almost 20 times the line voltage and will be passed to the secondaries in proportion to the step-down ratio of the transformers. If you plan to power a board containing LSI chips, use an MOV. I used a GE V220MA4B. I will supply this part if you have trouble finding it in your area. Include a stamped, self-addressed envelope and a check for $2.25 (VA residents, include $.09 tax). Refer to the part number and KB8519.

The +5 V supply is powered from the 6.3 V transformer secondary. The rectifier shown is a full-wave bridge in a single package. If you prefer to use discrete diodes, use the equivalent circuit shown in Fig. 3. The filter capacitor should be at least 4000 uF for adequate filtering. The 5k bleeder resistor takes about 15 seconds to bleed the charge from the capacitor after power-off. The 1 uF and 0.1 uF bypass capacitors are not essential, since the regulator is close to the filter capacitor, but are good to have anyway.

Use a heat sink on the 7805, and you can get up to 1.5 amps regulated output with a TO-220 package. In the event of a short circuit across the regulator output, it will automatically shut down, so fuses are not required. The power-on LED is powered from the 5 V supply. If the +5 V supply is not needed, eliminate all components above the dashed line in Fig. 1.

The full-wave bridge for the balance of the supply is used as a half-wave bridge, with return going to the secondary centertap ground. Thus, the one centertapped secondary supplies plus and minus voltages at roughly three-fourths the secondary voltage. The S-100 bus requires +8 to 10 V for pins 1 and 51, +15 V for pin 2, −15 V for pin 52 and ground for pins 50 and 100.

An LM117 adjustable regulator is used to provide +9.8 V to pins 1 and 51. I chose the LM117 because it is easily adjusted and is good for 2 amps or so with a heat sink. The voltage output from the LM117 may seem strange, but results from using standard values for the two resistors. The formula for determining voltage output is $V_O = 1.25(1 + R/220)$, where R is the 1.5k resistor in Fig. 1, should you want to change the output voltage. Fig. 4 gives the pin-out for all regulators used in this design.

Since the +15 V and −15 V bus lines are low current, I chose to use a current limiting resistor and zener diode for regulation of each voltage. The current output is limited to about 70 mA, but has been sufficient for all my S-100 board testing thus far. Be careful that if you reduce the resistance of the dropping resistors (220 ohms for each voltage) to increase the output current, you don't exceed the current rating of the zeners. Zeners can be paralleled for increased current capacity, if necessary.

The dropping resistors are large enough to handle normal current demands, but if the outputs are shorted, the resistors will get hot after a minute or so. An electronic current limiter could have been incorporated, but I felt that it would have been overkill. Instead, I used two LEDs to indicate "voltage output OK." If a connection on the board under test is shorted, the appropriate LED will go out.

As a safety precaution, don't remove the board under test until the LEDs have gone out, indicating that the filter capacitors have been discharged. Also, never install a board into the card edge connector if the

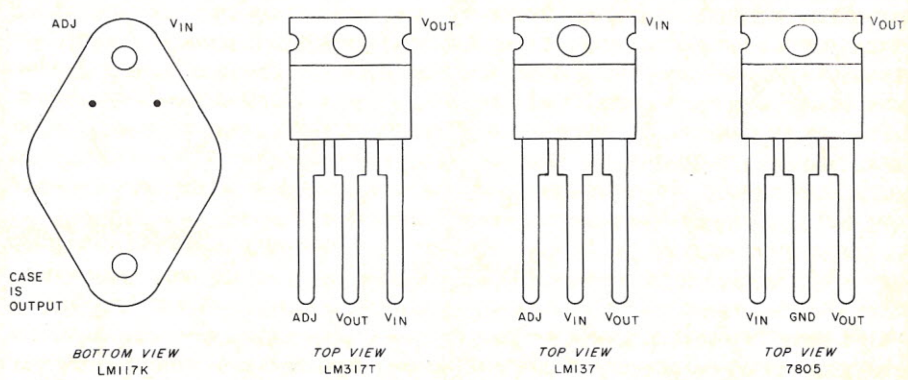


Fig. 4. Pin-out of all regulators used in this design. Be sure to use adequate heat sinks when soldering to the regulator terminals, and use a solder lug for the LM117k case connection.

power is on—same as installing boards into the system bus. The S-100 voltage taps are wired to the card edge connector and are not available for general-purpose use. If the S-100 module is not needed, simply eliminate sections A and B in Fig. 1.

The variable voltage board (shown in Fig. 5) provides adjustable voltages to ±22 V at currents up to 1.5 A. The two adjustable regulators LM317T and LM337T provide adjustability while maintaining constant voltage regulation.

The regulators can be adjusted over a 40 V range; i.e., the V_{out} to V_{in} differential can be as large as 40 V. Thus, regulated outputs to ±40 V are possible by increasing the transformer secondary ratings.

In my setup, the variable voltage board was the only portion of the design built on a printed circuit board, but it could have been hand-wired like the balance of the unit. If the variable voltage module is not needed, simply break the circuit at points C and D in Fig. 1.

Component Substitution

Whenever possible, it is always nice to be able to use components from stock, rather than buy them. That raises the question of component substitutability. With the present design, as with most power supply designs, voltage and current requirements pretty well establish component values. For example, the specified regulator ICs can provide up to 1.5 to 2 amps, as noted above. Thus, they and all associated current-carrying components must be sized for the rated current and heat-sinked as appropriate.

The transformer secondaries and the rectifiers must be capable, assuming worst-case conditions of all supplies drawing full current simultaneously, of the total current draw for each supply. Whether that worst-case assumption pertains to each user is an individual judgment, but it is better to err on the side of oversized components during construction, rather than have to replace underrated components, or build a heavier-duty supply later. Of course, it is inadvisable to use a 10 amp secondary when 3 or 4 amps will suffice.

The voltage rating of the capacitors and rectifiers is much more clear-cut. To determine the necessary PIV rating, multiply the rated secondary voltage by 1.4 to determine the peak rectified voltage. Then add 20 per-

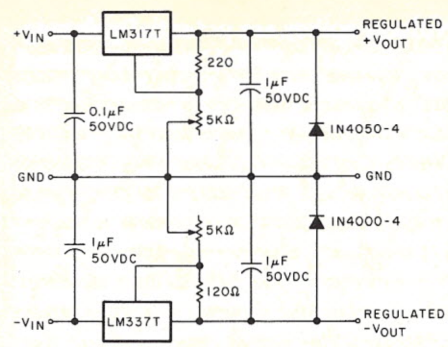


Fig. 5. Circuit diagram of the variable voltage board. All resistors are ¼ W.

cent for a safety margin for voltage spikes. For example, if the secondary voltage is stated as 6.3 V dc, the peak rectified voltage will be about 9 V. Thus, the minimum voltage rating of the rectifiers and filter capacitors should be 11 V dc.

The capacitance value of the filter capacitors could be established mathematically, but suffice it to say that the values given in Fig. 1 are minimum values. An increase of two to three times the values given would be acceptable, although of little benefit to the system. Large values of filter capacitance are generally beneficial only at high current loads.

Construction Techniques

One objective of this design is to allow flexibility in choosing components. Another is to make the design modular so that unnecessary sections can be omitted without affecting overall operation of the unit. While originally conceived as a test fixture and breadboarding aid, I wanted the design as it evolved to be convenient for hobbyist use (board testing or small system power supply). A number of changes have taken place, as evident from the extra holes in the perfboard.

I used an LMB 141 chassis box, although there are better-looking boxes available. When wiring the ac portion, follow the guidelines above under the safety section. Use 24 AWG leads minimum to wire in the 7805 and LM117 regulators and from the regulators to the voltage output points. Use 26 AWG minimum elsewhere. Use a grommet to bring all leads from the box.

Diode bridges are more convenient to use and take up less board space than the equivalent discrete diodes, but the choice of rectifiers is a minor one. Be sure to provide a good heat sink for each of the regulator ICs—the safe output current is appreciably reduced if heat sinks are not used. Be careful not to mount all regulators on the same heat sink, or even allow the heat sinks to touch.

As can be seen in Fig. 4, the potential of the case or mounting tab varies according to the regulator. If the heat sinks touch, you'll destroy the regulators. Put a film of silicone grease between the regulator and the heat sink; then screw the two tightly to the board.

I used a printed circuit board for the variable voltage board, which was a patch from a previous power supply design; it could just as easily be wired to the perfboard.

Banana jacks are used for output terminals. Any suitable screw-type terminal boards are inconvenient but are less expensive. If you use banana jacks, be sure to color-code them so you can tell at a glance which polarity is which. Label all terminals, regardless of what type you use.

Installation of the S-100 card edge connector is straightforward. Simply wire up the appropriate pins as shown in Fig. 1. Be sure to use insulation tubing over the connector pins to prevent shorting the power leads to adjacent connector pins. Also, be sure to include a polarization device with the connector so that a board cannot be accidentally installed backwards.

Power-up and Enjoy

So there you have it—a modular power supply design with numerous applications. As illustrated, the power supply makes an excellent power test fixture for S-100 boards, in addition to supplying separate outputs of +5 V at 1.5 amps and variable voltages to ±22 V at 1.5 amps.

In addition to testing S-100 boards (or any others), the supply has enough power to drive a small system or a single-board computer. Working with dual-supply operational amplifiers is easy with the variable voltage section, and the +5 V supply has enough capacity to power extensive breadboard circuitry.

Being modular in design, sections not needed can be eliminated or added later. If you are working from a very limited budget, sections can be added as the finances allow. The fully stuffed version can be built for $40 or less, depending upon how well your junk box is stocked. You should never need another general-purpose power supply after building this one. Power up and enjoy. ■

Here's a look at some inside information on how Heath's disk operating system handles disk files.

Dissecting the HDOS Diskette

By E. Tom Jorgenson

Like so many computer manufacturers before it, Heath has withheld a great deal of information from its users concerning how HDOS handles disk file space.

Such lack of information is a major obstacle to recovering from diskette crashes, when it is often necessary to reconstruct files on a diskette by hand. Rebuilding files sector by sector requires intimate knowledge of the diskette structure, and until now few outside of Benton Harbor have had this knowledge.

In this article, I will try to reveal much of this formerly unavailable wisdom. Armed thus, you should in the future be able to salvage most of the data on a crashed diskette in some usable form.

Review

Data is recorded on the diskette surface in concentric circles called tracks. The number of tracks is dependent upon the material used, the recording head and the reliability required. Originally, due to problems reading the inner tracks, floppy-disk drives contained a maximum of 35 tracks; these days we can use 40 tracks with very high reliability, as HDOS does.

Each track is further subdivided into ten sectors (Fig. 1). In our case these are hard sectors, each of which has an individual hole cut into the diskette, one per sector, to mark its position within the track. Sector 0 has an additional hole between the other two, which yields a total of 11 holes around the inner rim of the diskette.

Initial bytes:	Nulls
First byte:	Sync (0FD hex)
Second byte:	Volume number
Third byte:	Track number
Fourth byte:	Sector number
Fifth byte:	Header checksum

Table 1. HDOS sector header.

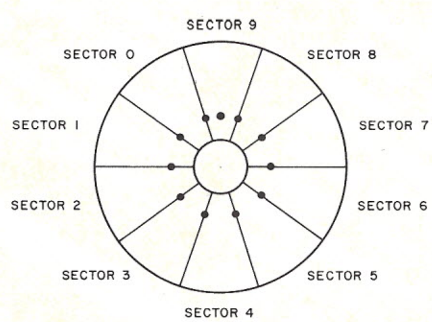


Fig. 1. Sector division of a track.

An LED and phototransistor within the floppy-disk drive uses these holes to produce sector pulses, which then can be monitored by the operating system to locate the start of a sector.

The HDOS Sector Header

HDOS could locate any sector on the diskette by first positioning the head on the correct track and then counting the number of sector pulses from the sector 0 mark generated by the drive. There is an inherent problem in such a scheme, however, in that the system could become lost by reading the wrong number of track or sector pulses.

Fortunately, HDOS does not subscribe to such a simple scheme.

During the initialization process, HDOS writes a dummy sector within each physical sector. This dummy sector consists of two parts: sector header and data area.

The leading nulls in the header (Table 1) give the system some "slop" in head positioning since they will be ignored (as will anything before the sync byte). The sync byte (0FD hex) tells the floppy-disk controller electronics exactly when a sector header is under the drive head.

As you can see, the volume, track and sector bytes uniquely identify each sector on the diskette, and the header checksum identifies any errors that occur in reading this header.

If an incorrect volume byte or header checksum is read a number of times in succession, HDOS will call the sector bad. An incorrect track or sector byte will cause a new sector search to begin (with the associated nightmarish sounds from the drive stepper motor).

Using a sector header such as this, HDOS needs merely to read one sector to determine precisely where on a diskette the head is currently positioned. There is no chance of getting lost, as with the more primitive method. Additionally, we gain a speed increase in sector searches, since HDOS does not need to spend a lot of

Address correspondence to E. Tom Jorgenson, 122 Yankee Drive, St. Charles, MO 63301.

time just in locating the desired sector. The advantages far outweigh the small amount of overhead we pay in creating and detecting the sector headers.

Notice that each sector contains the volume number of the diskette. This is done so that no read or write operation will succeed to any diskette not correctly mounted by HDOS.

Diskettes formatted on the Heath-Lifeboat CP/M system all normally have volume numbers of 0.

The Sector Data Area

Immediately following the sector header and completely within the same physical sector is the data area (Table 2).

Within the data area the nulls, sync bytes (also 0FD hex) and checksum perform the same basic functions as they do within the sector header.

The remainder of the data area consists of the actual 256 bytes in which we are really interested. During normal operations the sector formatting (header, sync bytes and checksums) is completely invisible to the operator.

Special Areas

Once INIT has written dummy sectors throughout the entire diskette, it next creates five special areas necessary for the HDOS file-handling techniques (Table 3).

Bootstrap area. The bootstrap area on the diskette contains the loader module for the operating system. When the HDOS system is cold-booted (i.e., brought up from scratch), the first four sectors (track 0, sectors 1 through 4) are loaded into memory and executed. These sectors provide the basic information necessary to locate—and load—the first part of HDOS (HDOS.SYS) into memory.

Label identification sector. The next reserved diskette area (track 0, sector 10) is used by HDOS to store some very basic facts about the diskette in question.

Initial bytes:	Nulls
First byte:	Sync (0FD hex)
Next 256 bytes	Data bytes
Last byte:	Checksum

Table 2. HDOS data area format.

Most importantly, this sector tells HDOS where to locate the start of the diskette directory and the GRT (group reservation table) sector. These two areas are the pointers to all the remaining files on the diskette.

HDOS has the ability to read files in small groups of sectors called clusters. Since these cluster sizes can apparently be varied from diskette to diskette, HDOS stores the current cluster size here also.

The remaining information within this sector is doubtless more familiar to you. This sector is also where the volume identification number and title are stored.

Reserved group table (RGT). The next sector we come upon (track 1, sector 1) contains the diskette RGT map. This sector allows HDOS to lock out bad clusters on the diskette with INIT.

Byte values within the RGT show the current status of the individual clusters in the same relative diskette positions. Usable clusters are marked with a 01 byte. Zero or any negative value locks sectors out.

When INIT formats a new diskette and prepares to write a blank directory, it first looks for a large enough number of good sectors in which to write it. Any bad sector returns will cause HDOS to lock out their clusters within the RGT. This is the only circumstance I know of that can cause a directory to be repositioned from its normal location (track 22, sector 2) on the diskette.

Track 0 is always locked out, since it is intended to be available for system use only.

HDOS directories. The directory or-

Bootstrap area	Sectors 1 to 4	Contains bootstrap loader for HDOS.SYS
Label identification sector	Sector 10	Diskette identification
Reserved group table (RGT.SYS)	Sector 11	Sector lock-out map
Directory (DIRECT.SYS)	Usually starting at sector 222	Actual file entries
Group reservation table (GRT.SYS)	Usually sector 238	Diskette cluster linkages

Table 3. Reserved areas on the HDOS diskette.

File entry #1
File entry #2
File entry #3
. . .
File entry #22
0 byte
Single byte entry length
Two-byte block number of this cluster
Two-byte block number of next cluster

Table 4. Directory cluster block format.

dinarily contains nine clusters of 22 entries each for a total of 198 possible entries (Table 4). This is actually 22 more entries than the number of files it is currently possible to write on the diskette, so don't worry about writing too many file entries under HDOS.

As shown in Fig. 1 each directory cluster points to the next cluster until the last cluster points to cluster 0. This is necessary since the initial directory read operation cannot treat the directory itself as a file—it simply doesn't know at this point where on the diskette the directory cluster will be or how to find out otherwise. Such information only becomes available once the directory is read. It's the old chicken-or-the-egg story all over again.

Directory clusters also individually specify their own internal entry lengths. Apparently it would be possible to allow for longer file names than are currently being used by patching the directory clusters. This is but one of the hidden possibilities of HDOS.

Each directory file entry (Table 5) consists of the same 23-byte format as shown.

These directory entries contain all the information necessary to tell HDOS how to read the file and where to begin (and end) reading it on the diskette. The cluster factor tells HDOS how the file is intended to be read (sectors per operation). First and last group numbers specify the starting and ending clusters within the file. The last sector within the last cluster is specified by the last sector index.

The first byte of the file name is used to mark files as deleted (with a 0FF hex byte) and to mark the end of usable entries (with a 0FE hex byte). Files recently deleted—and not overwritten—can be recovered by restoring this byte to its former ASCII value. Any directory entries after a 0FE byte here will be ignored.

See List of Advertisers on page 194

File name	8 bytes
Extension	3 bytes
Project	1 byte
Version	1 byte
Cluster factor	1 byte
Flags	1 byte
(S=200Q, L=100Q, W=40Q, C=20Q) Reserved	1 byte
First group number (FGN)	1 byte
Last group number (LGN)	1 byte
Last sector index (LSI)	1 byte
Creation date	2 bytes
Last alteration date	2 bytes

Table 5. Directory entry format.

After the file name and extension are two bytes which appear not to be currently used. These are reserved for the current project number and version. What the exact purpose of these bytes is, we can only guess—possibly they are only for internal use in Benton Harbor.

The next byte contains the cluster size to use in reading the file (usually 3). Obviously, from its appearance here, this may be varied from file to file.

Currently there are four types of file flags in use, the three we all know (SLW) and one undocumented flag, the C flag.

The C flag identifies which files must be written contiguously; i.e., in direct sequence from start to finish. This flag can be displayed by using the /JGL switch in PIP.

After the next byte, which is reserved for future use, are three bytes which uniquely identify the file clusters allocated to a file. The first two of these bytes contain the starting cluster number and the last cluster number. These values are in terms of the cluster factor stored in the label identification sector.

HDOS clusters are numbered in a sequential fashion without skewing. Track 0, sector 3, for example, is within cluster 1, and track 22, sector 2 begins cluster 111.

The third byte is the last sector index within the cluster. Since a file may only use part of a cluster, this byte tells HDOS exactly which sector is the last within the file.

Finally, we come to the file dates. The dates are encoded into two bytes each in packed manner (Table 6).

The first of these, the last alteration date, is the date we normally see displayed by HDOS. This date shows the last date on which the file was modified.

Although not normally displayed,

Bits 1 through 5	Day (1–31)
Bits 6 through 9	Month (1–12)
Bits 10 through 15	Year (Year–70)
Bit 16	0

Table 6. Packing dates in HDOS.

the directory entries also contain the original creation date of the files. This is encoded within the last two bytes of the file entries.

Group reservation table (GRT). HDOS locates file clusters on a diskette dynamically. If a file uses cluster 36, for example, the next cluster within the file is not necessarily cluster 37. It is possible to link any two clusters not otherwise in use together within a file.

This is done to make maximum usage of the empty disk area. Imagine that (as under older systems) an operating system were always to write a new file into the largest blank space available at the time. The system would work very well until it reached a point where it had a large file to write into a number of smaller empty spaces. The system could not then use the smaller spaces until they could be squeezed together into at least one space large enough to contain the current file.

This is the advantage of a dynamic file scheme. The system makes use of all the available blank space without concerning itself with whether or not it is in one large group or fragmented all over the disk. HDOS really gives the ability to do both (remember the C switch), although it normally uses the dynamic mode.

For this reason, the directory only points to the beginning and end of a file. The actual cluster linkage is stored within the GRT.

Groups of clusters are strung together within the GRT to form what HDOS calls chains. Even unused clusters are linked into a free chain.

When HDOS begins reading a file, it starts at the cluster specified by the directory entry. The next cluster read will be pointed to by the byte in the first cluster's relative position within the GRT. This process continues until the entire file has been read. The byte in the last cluster's position contains zero—which verifies that the file entry within the directory is correct, since the last group numbers should match.

In this manner, if the last cluster we read was 26, byte 26 in the GRT contains the next cluster number we should read (or 0 if we are finished).

The free chain is linked to cluster 0. This we can do since cluster 0 is part of the system area and is locked out by the RGT.

Corrupt Diskette Structures

One problem with such a complex dynamic file scheme is that it can lead to a rather spectacular diskette demise.

If the RGT, GRT or directory are overwritten, or written incorrectly, our file linkage chains may no longer match the directory entries or usable sector map.

Perhaps two directory entries reference the same diskette cluster or a file attempts to link to a lock-out sector. Such situations indicate corruption of the diskette file structure.

When HDOS tries to mount a diskette, these linkages are tested (and in some cases updated). If any contradictions are found you will get that wonderful "Disk Structure Is Corrupt" message and an instruction to contact the Heath technical assistance department. This is because Heath is trying to protect us from further damaging the file structure by preventing further diskette write operations.

A better way of handling this situation might have been to make the

✓See List of Advertisers on page 194

diskette mount as read-only. Currently the corrupted diskettes can only be read using absolute track and sector utilities (such as the ABSDUMP utility available from HUG).

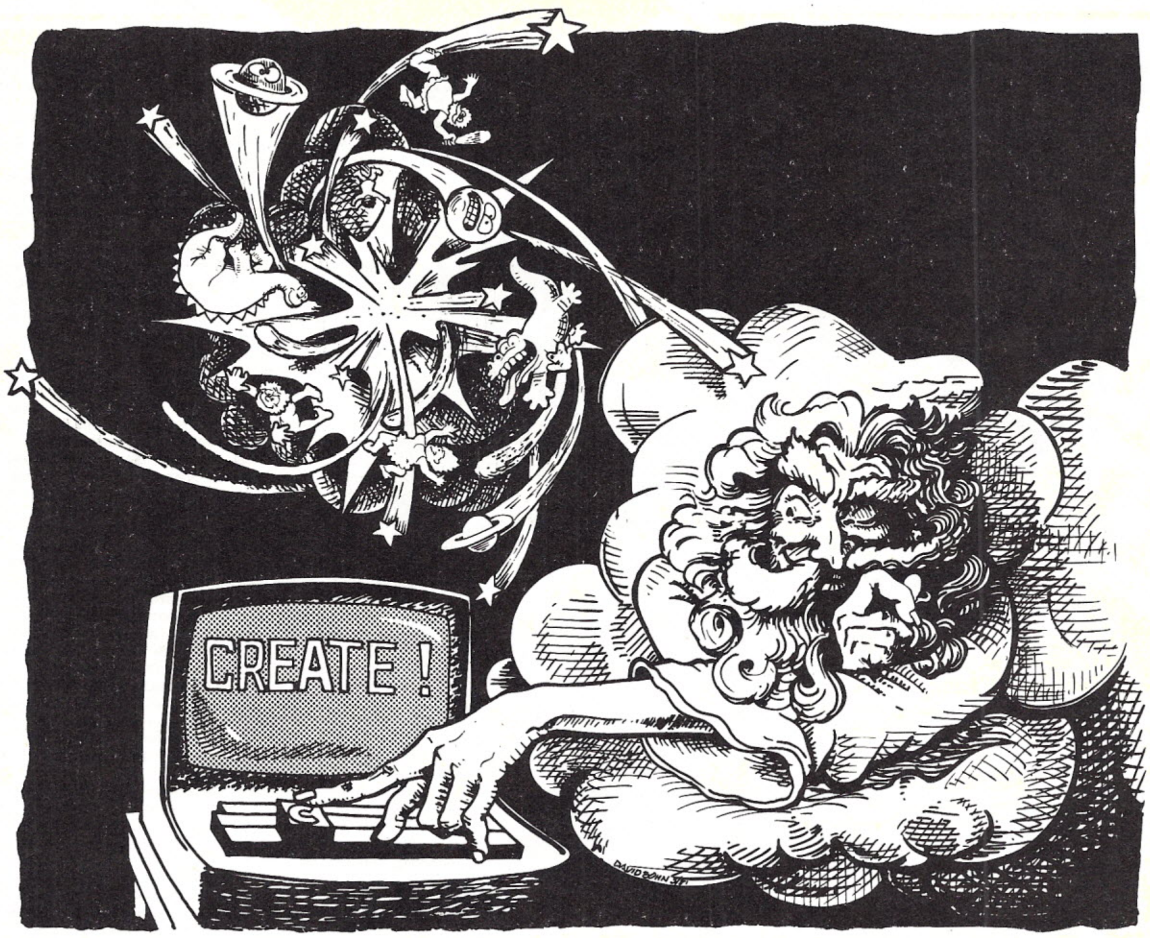
Summary

HDOS is an amazingly sophisticated system as microcomputers go. A number of file-handling features are incorporated which are not available on many similarly priced systems.

It is appropriate indeed that Heath Company is beginning to free up a great deal of information to its users. Certainly this article would never have been possible had this not been the case. Heath has always been more responsive to its users than its competitors have been, and just recently this has also become true of its response to its computer hobbyist customers.

I am sure that, as more and more information such as this becomes apparent, we Heath users will see an explosion of very powerful utilities coming our way.

Perhaps the H8/H-89 will finally take its rightful place among the giants of the industry.■



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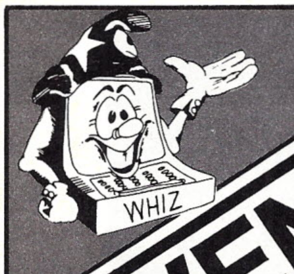

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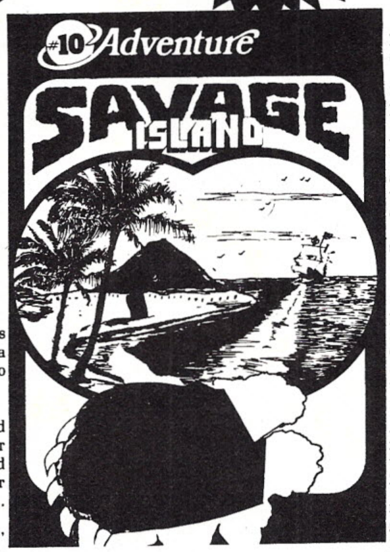

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ADVENTURE PROGRAM PARAMETERS

LANGUAGE	Machine
NUMBER OF PLAYERS (min/max)	1/1
AVG. COMPLETION TIME	1 month
SUGGESTED AGE GROUP	12 to Adult
RECOMM. FOR NOVICE?	(0-2) Yes (3-10) No
CLASSIFICATION:	Compu-novel
SOUND?	No
GAME SAVE FEATURE?	Yes
MULTIPLE SKILL LEVELS?	No
GRAPHICS ORIENTED?	No
REAL TIME?	No
SPECIAL EQUIPMENT:	None

Adventures by Scott Adams

AN OVERVIEW

I stood at the bottom of a deep chasm. Cool air sliding down the sides of the crevasse hit waves of heat rising from a stream of bubbling lava and formed a mist over the sluggish flow. Through the swirling clouds I caught glimpses of two ledges high above me: one was bricked, the other appeared to lead to the throne room I had been seeking.

A blast of fresh air cleared the mist near my feet and like a single gravestone a broken sign appeared momentarily. A dull gleam of gold showed at the base of the sign before being swallowed up by the fog again. From the distance came the angry buzz of the killer bees. Could I avoid their lethal stings as I had managed to escape the wrath of the dragon] Reading the sign might give me a clue to the dangers of this pit.

I approached the sign slowly.

And so it goes , hour after hour, as you guide your microcomputer through the Adventures of Scott Adams in an effort to amass treasures within the worlds of his imagination.

By definition, an adventure is a dangerous or risky undertaking; a novel, exciting, or otherwise remarkable event ot experience. On your personal computer, Adventure is that and more.

For the user, playing Adventure is a dangerous or risky undertaking in that you better be prepared to spend many addictive hours at the keyboard. If you like challenges, surprises, humor and being transported to other worlds, these are the games for you. If you dislike being forced to use your common sense and imagination, or you frustrate easily, try them anyway.

In beginning any Adventure, you will find yourself in a specific location: a forest, on board a small spaceship, outside a fun house, in the briefing room of a nuclear plant, in a desert, etc.

By using two-word commands you move from location to location manipulate objects that you find in the different places, and perform actions as if you were really there. The object of a game is to amass treasure for points or accomplish some other goal. Successfully completing a game, however, is far easier to state than achieve. In many cases you will find a treasure but be unable to take it until you are carrying the right combination of objects you find in the various locations.

How do you know which objects you need? Trial and error, logic and imagination. Each time you try some action, you learn a little more about the game. Which brings us to the term "game" again. While called games, Adventures are actually puzzles because you have to discover which way the pieces (actions, manipulations, use of magic words, etc.) fit together in order to gather your treasures or accomplish the mission. Like a puzzle, there are a number of ways to fit the pieces together; players who have found and stored all the treasures (there are 13) of Adventure #1 may have done so in different ways.

In finding how the pieces fit, you will be forced to deal with unexpected events, apparent dead ends and Scott's humor, which is one of the best parts of the puzzles.

If you run into a barrier like not being able to discover more rooms, don't give up. Play the game with some friends; sometimes they'll think of things you haven't tried.

While I pondered how to reach the throne room — which I was sure contained the treasures of Croesus — the fog grew thicker and the hours passed. I realized I would not be able to outwit Adams today...but maybe tomorrow. I marked my present location on my tattered map and began the long trip to the surface. As I dragged myself off to bed, I thought about other possible Adventures.

But enough for tonight. Tomorrow — another crack at the chasm.

—by Ken Mazur

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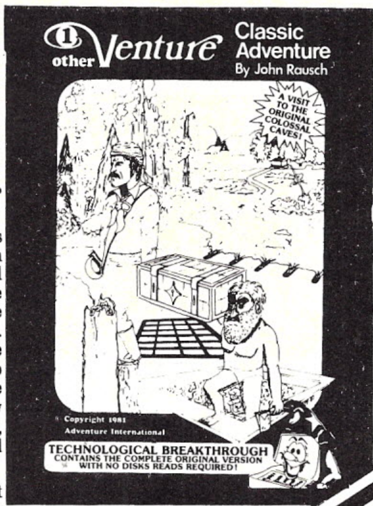

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Write assembly-language programs for your Atari with this powerful ROM cartridge.

Atari's Assembler Editor

By Robert W. Baker

The Atari Assembler Editor cartridge (CXL4003) contains three separate programs for developing 6502 assembly-language programs. It is available from any Atari dealer for $60.

The Editor helps you write programming statements in a form the Assembler program understands. The Assembler program then takes the program statements you create in the edit step and converts them to machine code. A handy Debugger program helps you trace through the program steps by running your program a step at a time while displaying the contents of important internal 6502 registers.

You can also display and/or change registers or memory, move memory, list memory, disassemble, assemble single instructions into memory, execute code and so on.

The accompanying manual assumes the user has read some other book on assembly language or is already familiar with it. It also assumes you know how to use the screen editing and control features of the Atari 400/800 computer system. These features are the same as those used in Atari BASIC. Thus, the manual primarily explains the operation of the Assembler Editor cartridge. It does not explain 6502 assembly-language programming or programming techniques.

You need not have any equipment except the computer system console, your television or video monitor for display and the Assembler cartridge. However, without a permanent storage device (tape or disk), you will have to enter your program on the keyboard each time you want to use it. For assembly-language programs this task is much more tedious and time-consuming than with BASIC programs. Therefore, an Atari 410 recorder or 810/815 disk drive is a practical necessity when you use the Assembler Editor cartridge.

The Assembler Editor cartridge was designed to be used with the Atari disk drives and DOS II. If you are currently using DOS I, the 9/24/79 version of DOS, then you must patch several locations within DOS to be compatible with the Assembler Editor cartridge. The instructions for this are included in the Assembler Editor manual.

Even though the programs were designed to be used with a disk, they are still usable with a 410 program recorder. If you're going to be doing any reasonable amount of assembly-language programming, you'll probably also want to have one of the Atari printers so you can get printed copies of the assembly listings. This can be helpful when debugging programs.

Storing the Program

All assembly-language programs are divided into two parts: a source program, which is a human-readable version of the program, and the object program, which is the computer-readable version of the program. With the Atari assembler, these two versions of the program are distinct and must occupy different areas of RAM memory.

The source program must exist in RAM memory in order to assemble it, but the object program it produces must be put in a different area of memory, so as not to destroy the source program. Therefore, the first decision you must make when writing the source program involves the allocation of available memory space.

Normally, when you program in BASIC, the system automatically allocates portions of memory for the program, data, display space, etc. This is not quite the case with the Assembler Editor cartridge. You now can place your programs anywhere in memory that you wish, but you must allocate memory wisely.

The Atari computer system uses low memory for its own internal needs. The amount used depends on whether or not DOS is loaded into RAM. In any event, the Assembler Editor cartridge will automatically place your source program into mem-

Robert W. Baker (15 Windsor Drive, Atco, NJ 08004) writes the monthly PET-pourri column in Microcomputing.

```
                10 ;
                20 ;SAMPLE PROGRAM
                30 ;
0000            40          *=    $0600
00CC            50 TEMPL    =     $CC        TEMPORARY HOLDING
00CD            60 TEMPH    =     $CD        LOCATIONS
00D4            70 RESLTL   =     $D4        ADR FOR RESULTS
00D5            80 RESLTH   =     $D5        ADR FOR HI RESULT
                90 ;
0600 68         0100 EXCLOR PLA
0601 68         0110        PLA
0602 85CD       0120        STA   TEMPH      SAVE HI BYTE
0604 68         0130        PLA
0605 85CC       0140        STA   TEMPL      SAVE LO BYTE
0607 68         0150        PLA
0608 45CD       0160        EOR   TEMPH      PERFORM HI EXCLUSIVE OR
060A 85D5       0170        STA   RESLTH     STORE RESULT
060C 68         0180        PLA
060D 45CC       0190        EOR   TEMPL      PERFORM LO EXCLUSIVE OR
060F 85D4       0200        STA   RESLTL     STORE RESULT
0611 60         0210        RTS
0612            0220        .END
```

Sample program. Graphics format instructions.

ory starting with the first free memory location.

As you enter and/or delete source code, the edit text buffer grows or shrinks accordingly. You also have to remember that a small area above the edit text buffer is used by the assembler for a symbol table when assembling your source program.

The problem now is where to store the object code produced by the assembler. If you put the object code into an area used by the operating system, DOS or display RAM, you'll probably cause the computer to crash and lose all your typing. Even more chaos can result if you try to put the object code into the area used by the edit text buffer. The only safe place to put your object code is in the empty memory area between the top of the edit text buffer and the bottom of the display RAM.

You can find out approximately where the empty memory area starts by using the editor SIZE command. The Assembler Editor will respond with three hexadecimal numbers, the last two representing the bottom and top addresses of the empty area. The first number indicates the bottom of usable RAM, typically about 180 bytes before the start of the edit text buffer. With these values you can estimate a reasonable starting location for your program, if you know the approximate size of the program.

Another alternative exists if your program and data will fit into 256 bytes. The 256 locations of page 6 ($0600–$06FF hex) have been set aside for your use by the Assembler Editor. This is a good safe way to start when you are still learning assembly-language programming and you are writing only short programs. Later, as your programs grow larger, you can move them off page 6 and use page 6 for data and tables.

Still another strategy is to bump the edit text buffer containing your source program upward in memory, leaving some empty memory space below it. A special Assembler Editor command, LOMEM, can be used to specify the new bottom address of the edit text buffer. However, if you intend to use it, this command must be the first command entered after turning on the computer with the Assembler Editor cartridge installed. There is no check on the value entered, so you must be careful not to set it too low, so as to crash the system, or too high, so there isn't room for the source program.

Creating the Source Program

The actual source program you write will contain many program statements representing machine instructions or assembler directives. Each statement can be up to 106 characters long. Any statement can have up to five parts, or fields: the statement number, a label, the operation code or assembler directive, an operand and a comment. These fields appear in successive positions in the statement line, each separated by a space.

Every statement must start with a statement number, just like the lines of a BASIC program. The Editor automatically puts the statements in numerical order for you. Numbering by tens or some other large increment allows space for inserting new statements. The Editor provides an automatic numbering mode for easy entry of new programs, and a command to renumber all existing statements.

A label, if used, occupies the second field of a statement. The label must start with a letter and contain only letters and numbers, but can be any length (up to 106 characters). Typically, labels are three to six characters long. Remember that each label is placed in a symbol table during assembly, using up valuable memory space. Thus, short labels help conserve memory. A label, if present, is assigned the current memory location before assembling the remainder of the statement. Each label can then be referenced by other instructions or statements as needed.

The operation code mnemonic indicates which 6502 machine instruction is to be assembled, and the standard 6502 mnemonics are used. The operand field, if required, is expected by the assembler and must be present. The assembler allows operands to be specified as hexadecimal or decimal numbers, symbols or expressions. Expressions can contain addition, subtraction, multiplication, division and logical AND operations. Instruction addressing modes use the standard 6502 assembly-language formats, making them easy to understand and recognize.

Comments can follow the operand field, or you can have a full line comment preceded by a semicolon. All comments are ignored by the assembler, but are printed in the program listing. With assembly-language programming it is important to include good comments to document the program logic for later reference.

Commands

The Editor provides several commands that make creating and editing source programs easier and faster:

NEW—clears the edit text buffer.

DEL—deletes specific statements from the source program. It can delete a single statement or a range of statements.

NUM—assigns statement numbers automatically as you enter source statements. Thus, you don't have to worry about numbering lines and assigning unique numbers; simply type in the source statements in order. Also, if NUM is entered later, it starts assigning statement numbers after the last statement currently in the source program. This makes it easy to add to an existing program.

REN—renumbers statements in the source program.
FIND—finds a specified character string in the source program. You can quickly find only the nth or all occurrences of the specified character string.
REP—replaces one string with a different string. You can perform the replace for a specific number or range of statements, or for all statements.
LIST—displays or saves a source program. The program can be listed to the display, printer, cassette tape or a diskette file. If you wish, a single statement can be listed.
PRINT—works just like the list command except statements are printed without the statement numbers.
ENTER—retrieves a source program from cassette or disk. Normally the edit text buffer is cleared before retrieving the indicated source program. An option to this command does, however, allow merging a program from tape or disk with something already in the edit text buffer.
SAVE—saves an object program on tape or disk. The hexadecimal starting and ending addresses of the area to be saved must be specified in the command.
LOAD—retrieves an object program previously saved on tape or disk. The object program is always reloaded in the same area of memory from which it was originally saved.

The ASM command is used to assemble the desired source file. It has various options that let you select various ways of handling the source program, assembly listing and object program. Normally the assembler assembles the source program in the edit text buffer. If you have a disk drive, the assembler can assemble the source program directly from a disk file. This function is not available if you only have a 410 program recorder.

The assembly listing is normally displayed on the screen as the assembly proceeds, but can also be printed or saved on tape or disk.

The object program is normally stored directly in RAM memory, at the address specified in the source program. If you have a disk drive, you can optionally have the object program stored directly in a disk file. Note that when you have a disk drive, the memory restrictions are somewhat relaxed since you can use disk files for the source and object. They do not have to be in memory at the same time, as when using cassette tape.

The assembler itself has several directives that you can use to control the assembler operation or create data constants. Directives are instructions to the assembler, and, in general, do not produce any assembled code or object output.

The .OPT directive controls generation of the assembly listing and page spacing, generation of the object program and the handling of error messages during assembly.

The .TITLE and .PAGE directives are most useful when the assembled program is listed on a printer. The .TITLE directive forces a top-of-form (or six blank lines) on the printer and prints a specified page heading. The .PAGE directive operates similarly, but adds a subtitle line below the title heading.

A .TAB directive allows redefining the positions for each statement field

in the assembly listing if the default values are unsuitable.

The .BYTE, .DBYTE and .WORD directives provide a simple way of generating numeric or character string data constants. These directives generate object output when assembled. The .BYTE directive generates single-byte values. The .DBYTE directive generates two-byte constants with the high-order byte first. The .WORD directive also generates two-byte constants, but in the standard 6502 address format (low-order byte first).

Another directive lets you define a symbolic label as a predefined or computed value. For more advanced programmers, there's an .IF directive for conditional assembly. This lets you control assembly of selected portions of the source program, depending on the value of an indicated variable or expression.

The * = directive defines the starting location for the assembled object program, and must be specified. Also, an .END directive must be specified at the end of the source program to tell the assembler where to stop.

The Debugger is called from the Editor by the BUG command. Once activated, you can use the Debugger to help analyze the execution of your program and then return to the Editor when ready to edit or reassemble. It should be noted that all values entered or displayed by the Debugger are in hexadecimal. The various Debugger commands include:

DR—display 6502 register
CR—change 6502 register
D—display memory
C—change memory
M—move memory
V—verify memory
L—list memory with disassembly
A—assemble one instruction into memory
T—trace operation
S—single-step operation
G—go, execute program
X—return to Editor

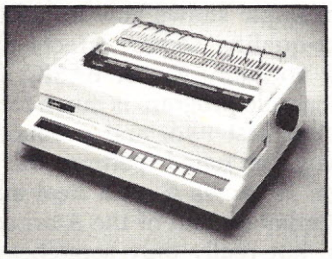
Program Features

The manual appendices include a list of Assembler Editor error numbers, assembler mnemonics and directives, the ATASCII character set and hints on using the Assembler cartridge to best advantage. Several interesting sample programs are included to illustrate using assembly language on the Atari.

The first sample program illustrates interfacing an assembly-language routine to a BASIC program. The second example shows how to produce higher-quality sound effects than you'd normally get in BASIC. The third sample program is much longer than the first two, and produces a pleasing animated pattern on the screen. It shows a great deal about the display system of the Atari computer, but really only scratches the surface.

The last program is probably the most interesting. It illustrates the display list interrupt and shows how to get more than five colors on the screen. The sample program produces all 128 colors on the screen at the same time.

For those who haven't seen this yet, the Sample program is a sequence of instructions that tells the computer what graphics format to use in putting information on the



screen. Many things can be done by changing the display list, but this example demonstrates one of those possibilities.

Basically, if bit 7 of a display list instruction is set (1), then the computer will generate a nonmaskable interrupt for the 6502 when it encounters that display list instruction. If you place an interrupt routine that changes the color values in the color registers, the color on the screen will be changed each time a display list interrupt is encountered.

Another interesting feature of the Atari system is that assembly-language routines can be stored in a string variable and executed from BASIC: A=USR(ADR(S$)). This requires that the assembly-language routine be relocatable (contains no JMP or JSR instructions), since it might be moved around if the BASIC program is edited. However, you don't have to know where the routine resides, since you can get the starting address of any string with the ADR(. .) function. Some examples on using this technique are included in the manual appendix, along with some problems that could occur. This is a powerful feature if properly used.

Conclusions

The Atari Assembler Editor cartridge is a useful addition to the Atari line. The assembler is powerful and can do a great deal, but it is not a professional software development system. It is not well suited for development of large assembly-language programs.

Atari recommends the Assembler Editor be used for development of programs up to approximately ten percent of the total memory size of the system. Thus, you could easily generate a 2K assembly-language program on a 16K system. Programs larger than this can be developed by eliminating comments, using short labels or breaking programs into manageable pieces.

The Assembler Editor is well suited to meeting the average user's needs. It provides all of the necessary features plus several useful extras. The only addition I think might be of value is a linking relocator, which would let you move programs in memory and automatically fix JMP and JSR addresses. Without this feature, you have to fix them manually. Even so, the package is very nice and well documented.■

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Expand your H-89 with Heathkit's new H-77 floppy drive.

Shift into Extra Drive On Your Heath

By Kirk L. Thompson

The H-77 floppy drive, Heath's newest eight-bit computer accessory, will greatly enhance your H-89 or—after modification—H-88.

A single drive is surprisingly limited when running sophisticated programs, and the additional drives will make data storage and debugging much easier. The added storage abilities become particularly obvious when you consider that a newly SYSGENed disk is half-filled with system files. Although many of these can be eliminated, the most you can gain back is half what you initially lost. The extra drives let you run a SYSGENed disk in SY0: and initialized-only disks in the others, for 94K (368 sectors) of storage each. The remaining 8K (32 sectors) are needed for the disk directory, label and other miscellaneous bookkeeping.

Assembly

I had anticipated that assembly would be easy compared with the H-89, and that proved to be the case. As is usual with Heath, the parts came packed in a carton, with the builder responsible for their organization. This kit was not too complicated, so organizing the small parts, after taking inventory, was easy. Many of them, especially the hardware pieces, were packed in labelled envelopes. The carton also contained parts for modifying the H-89. There were a few errata for the main construction manual, though nothing like those for the H-89.

Assembly took me about six hours. Most of that time was spent wiring the power supply and completing the mechanical assembly. The Siemens/Wangco Model 82 drives that Heath uses come assembled and tested. Photo 1 shows the completed power supply for the H-77.

The printed circuit board was simple and Heath's instructions were clear. I had two minor problems with the ac bracket, which is hidden behind the cover to the right in the photo. The solid wire supplied was easily nicked, and one broke after I had wired one of the line voltage selector switches. Use wire strippers, and be careful!

The other problem arose from the tight quarters Heath calls for when soldering to those same switches after the ac bracket has been fastened to the chassis (p. 18 in the assembly manual). I recommend just starting the sheet-metal screws into the bracket, so that it can be tilted away from the chassis to allow access.

Use a volt-ohmmeter after completing the power supply to ensure that it is working properly. The same applies if you modify it; I recently received another errata sheet detailing rewiring of part of the supply.

After finishing the power supply, I did the mechanical assembly. Photo 2 shows the completed kit, without the cover. You can see the Wangco drive on the right. Behind it, occupying the space for the second drive, is a plastic open-front box for storing diskettes, which came with the kit. The second drive may be added at any time and simply plugged in. The interface ribbon cable came assembled. Photo 3 shows the completed H-77. Except for the bezel, the cabinet is heavy sheet metal.

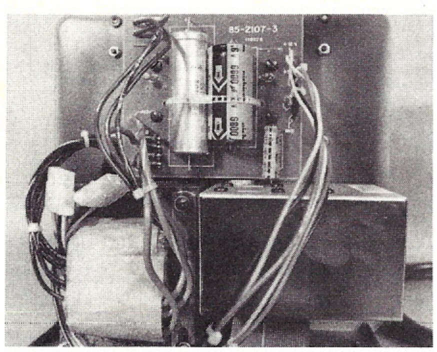


Photo 1. The H-77's power supply.

Modifications

After the kit is finished, the H-89 must be modified. I'll describe what I did first, and then talk about the H-88. The modification kit includes the preassembled adapter ribbon cable and items to insulate its route. Photo 4 shows the completed modification.

The adapter cable runs out through the gap between the two halves of the cabinet shell, between the rear hinges. However, I strongly recommend that you use additional cardboard insulators, as shown in Photo 5.

Insulator 1 is inserted between the adapter cable and the stepper motor of the drive in the H-89 cabinet. The stepper motor will get very warm with extended use. Insulator 2 goes between the cable and the power supply heat sink on the right in the photo.

For the H-88, there are two drive options. You can either use the H-77 as your only (preferably dual) drive unit, or, if you anticipate the need for the three drives now allowed under the newest version of HDOS, you can add a drive to the H-88 cabinet as well. The former is probably a good idea; the H-89 is pretty cramped inside.

In either case, you'll need the

Address correspondence to Kirk L. Thompson, 1817 C St., Iowa City, IA 52240.

H-88-4 drive kit, which includes the interface board that plugs into the microprocessor-board backplane beside your cassette and serial input/output boards. Adding that interface board effectively converts the H-88 to an H-89.

With the modification complete, it is now just a matter of positioning the H-77 and connecting the cables. They are polarized. When I ordered, I was afraid that the interface cable might be too short for my installation, but it wasn't. The cable of the H-77 extends four feet out the rear, and, depending on how you route the adapter cable, there is about a foot extending from the rear of the H-89. Photo 6 shows my system on the stand I kludged together for it. The interface cable is visible, draped over the rear of the upper shelf and falling down behind the H-89.

Testing

During construction of the H-77, you perform the drive speed test on the drive to ensure that it is within specification. When the kit is complete, the general checkout and seek-time tests must be run. These are described in detail in the HDOS manual, but I will make a few remarks about them here.

The general checkout test is a rather lengthy read/write test. You'll need to use a floppy with no bad sectors; I have not had a problem with any of the diskettes I've ordered from Heath. Since this test takes about half an hour to run, it is a good time to review the HDOS manual, particularly p. 14f of chapter one if you have only used one drive before. I'll explain why shortly.

The second test to run is for seek or step time between tracks of the hard-

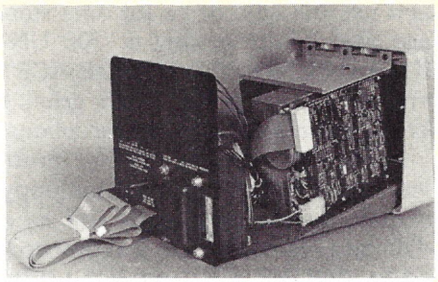


Photo 2. The single-drive unit without cover.

sectored floppy that Heath uses. They guarantee the drives for a minimum seek time of 30 ms. This test varies the seek time from 36 ms downward, in increments of two ms, to where stepping becomes unreliable.

On my H-77, I could actually hear it chattering during the last seek time tested. Both of my drives, the H-77 and the one in the H-89, step reliably well-below Heath's guaranteed minimum. The H-89 went down to 12 ms and the H-77 to 14 ms. To allow some safety margin, I have set system seek time to 16 ms using the SET SY: STEP n command.

Once I had decided on the system seek time, I removed the write-protect tab from my system volume copy and entered the SET command. In this way, any new floppies that I prepare for use will have the seek time already set. The disks I was already using, of course, had to be changed individually.

Operation

First, a warning. The power for the H-77 must be on before booting the H-89. Heath warns that the result of booting up with the H-77 off will be unreliable, because the I/O cable to the H-77 is unterminated without power to the drive. I thought I could develop the habit of turning them both on before use, but I forgot once.

This is what happened. While trying to boot up the system drive in H-89, I received the error message

?00 DISK READ ERROR DURING BOOT.

I reset the H-89 and tried again, but got the same thing. Then I realized that the H-77 was off, so I pushed on the rocker switch in back, reset the H-89 again and tried a third time. I got the same error message.

While booting, I had destroyed part of an HDOS file required for that operation. Note, though, that a write-protected disk, such as a system volume copy, will neither boot nor even generate an error message under these circumstances. Also note that it makes no difference whether the H-77 is on or off when loading from cassette.

Luckily, I had the nonsystem files on the partially destroyed disk in another location. I ended up recovering the disk by reinitializing (erasing its contents) and reSYSGENing it. If I hadn't had the files someplace else, I could have recovered them using the copy command between drives, or, if the H-77 were my only drive, one-copying (:OC:*.*). But copying between drives will not duplicate files flagged "S"; the flags have to be cleared first. I have installed a switched outlet strip which powers up both H-77 and H-89 simultaneously, to prevent the above situation from happening again.

Assuming, now, that both of them are on, you can boot up the system drive (SY0:). If you plan to use the second drive, you must inform the operating system by inserting a disk into it and typing MOUNT SY1:. This is where I confronted my most seri-

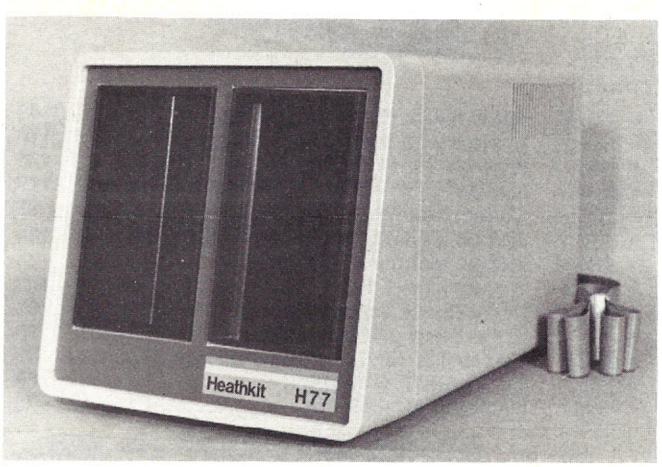


Photo 3. The completed single-drive kit with disk-storage box on the right.

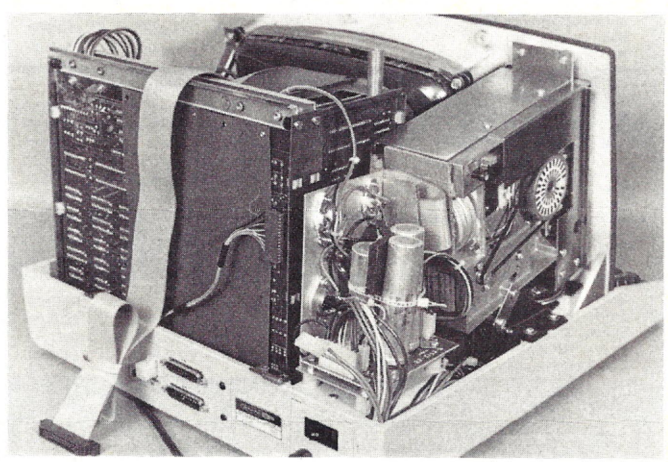


Photo 4. The modification of the H-89.

ous problem, while familiarizing myself with the H-77. (I had not reviewed the HDOS manual during the general checkout, as I recommend that you do.)

I was trying to run a Microsoft HDOS BASIC (MBASIC) program and use the new drive for data storage. But I kept getting a "?02 UNKNOWN UNIT FOR THIS DEVICE" error message! After much grief, I broke down and read the instructions.

I recently ran into another problem. I had booted up the minifloppy containing the program I use as a database system in SY0: and proceeded to MOUNT SY1:, but got a "?02 UNABLE TO READ THIS DISK. IT PROBABLY HAS NOT BEEN PROPERLY INITIALIZED" error message on an unSYSGENed disk that worked fine last time I used it. I tried other disks in the same operation, with the same result, and the STAT command showed one hard error and lots of soft ones.

On impulse, I dismounted all disks, shut down the system, and unplugged and reconnected the H-77's ribbon cable from the adaptor cable of the H-89, on the chance that a dirty contact was the problem. That did it! When I restarted the system with the same two initial disks, the MOUNT command worked and STAT showed no errors.

Since then I have had no problems with the H-77, or with the H-89. I have had some trouble with Heath's Extended Benton Harbor BASIC, but only because the first program I wrote required too many nested FOR-NEXT loops; converting to MBASIC solved that. I have also had some problems with one of the Heath Users Group's programs, but once again, it was my fault. I managed to mix the BASIC interpreter from HDOS version 1.5 with the version 1.6 operating system—the two are not compatible.■

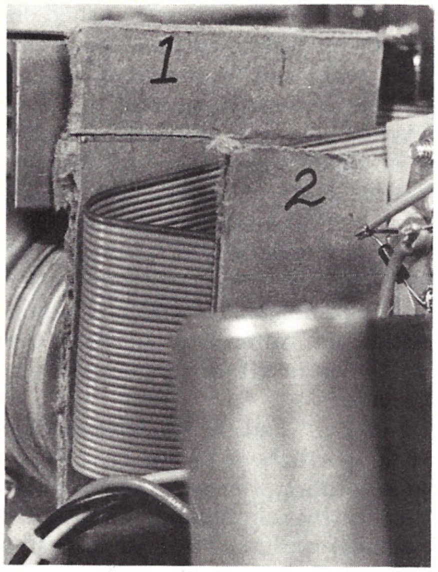


Photo 5. The suggested additional cable insulators (see text).

Photo 6. My system includes the cassette software. The lettering on the drives and file boxes is of the self-sticking vinyl variety.

And the Winner Is . . .

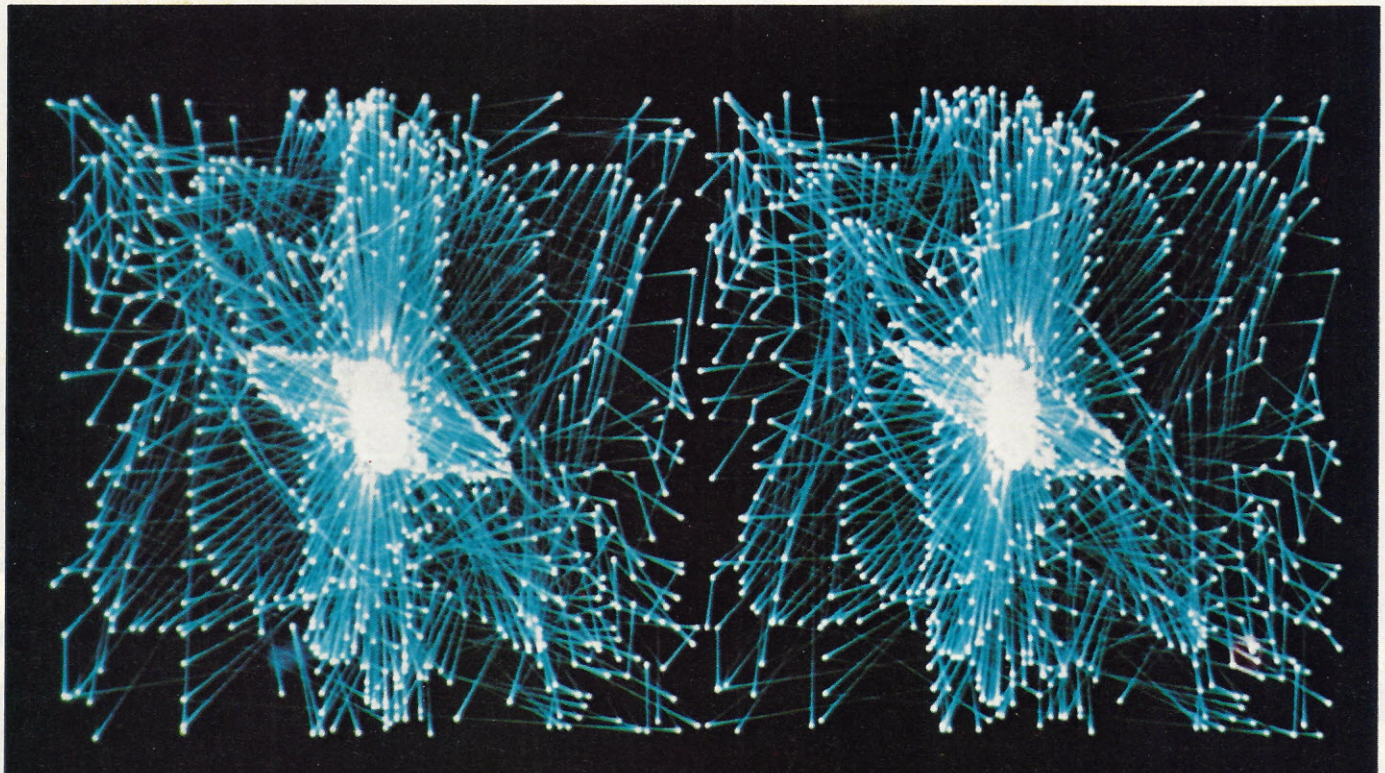
Here are the results of Microcomputing's first annual graphics contest.

The ballots have been cast, the votes have been counted, and the winner is . . .

Selecting the winners from among the entries in *Kilobaud Microcomputing*'s first annual graphics contest was indeed a difficult task. While some of the entries were produced on advanced microcomputer equipment and peripherals, other entries relied more on the skill and imagination of the programmer. The following pages show the winners and some of the more interesting entries which display the range of complexity in micrographics that can be achieved.

We extend our congratulations to the winners, and our appreciation to all who entered the contest. Thanks to you our first annual contest was a success. Let's do it again next year.

Those who failed to submit entries this year, but feel that they could have done better, will get a change to strut their stuff next year during the magazine's second annual graphics contest.

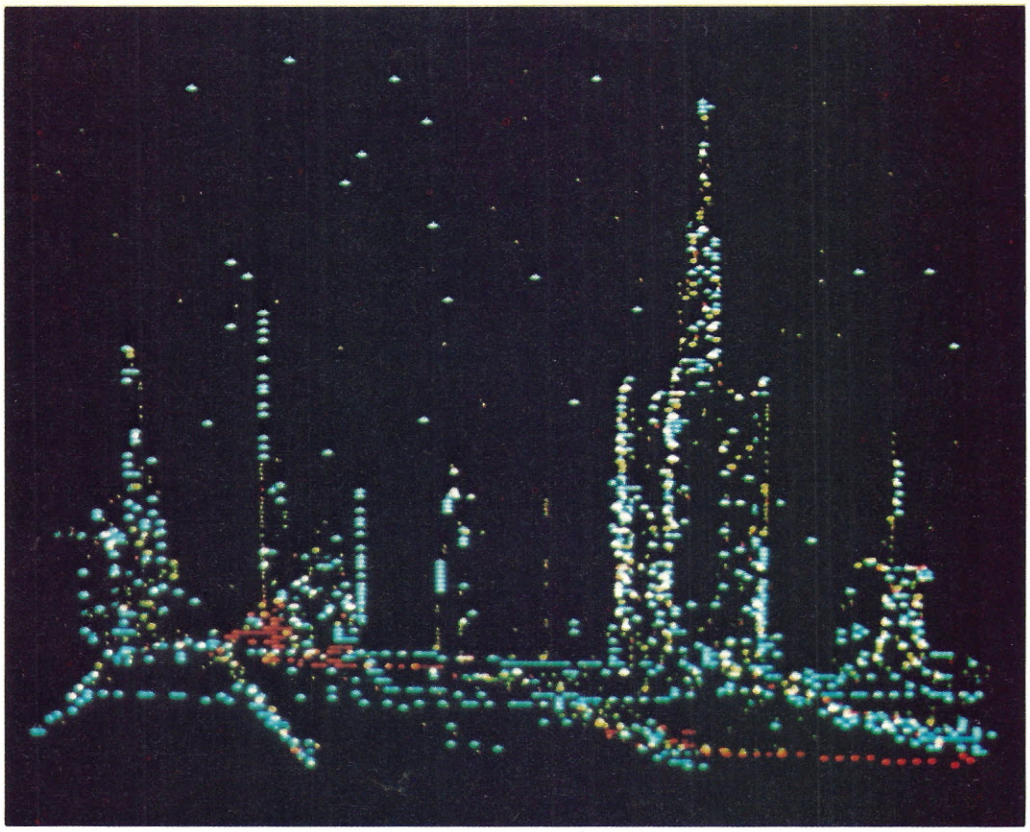


The Twins

Black & White Video

Produced with a home-brew 6800-based system on a modified television screen. *Second.*

Larry Abel
91 Forrest Ave.
Fairfax, CA 94930

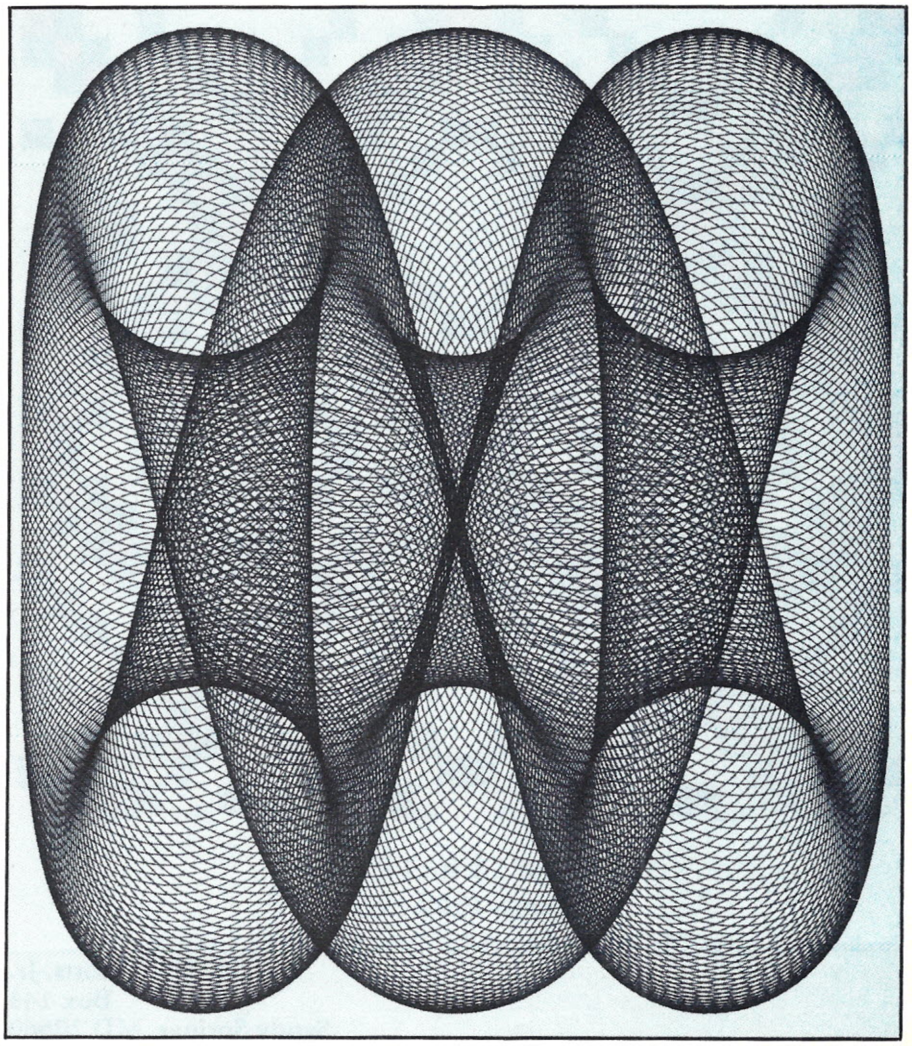


Night View

Color Video

Composed with VersaWriter on a 48K Apple II microcomputer, and displayed on an RCA Colortrac screen.

Ben Lanterman
12162 Haldane Court
Bridgeton, MO 63044

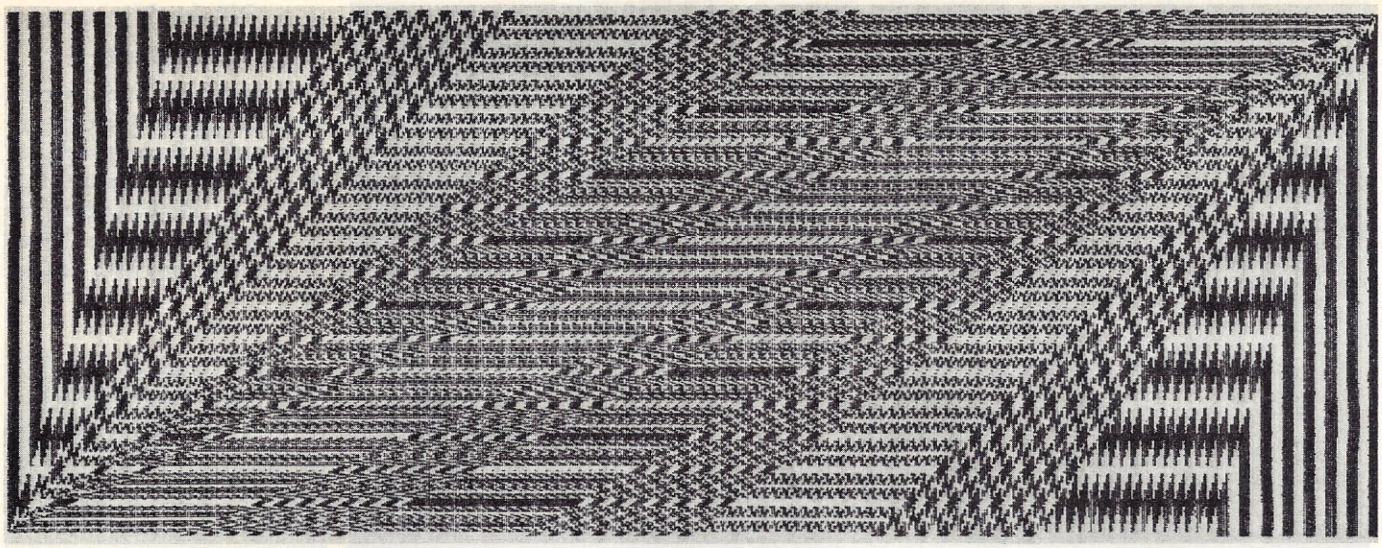


Helix Surface 3

Plotter Hard Copy

Produced on a Terak 8510A microcomputer and Hewlett-Packard 7225A plotter.

Mel Cobb
1520 Ward Ave., #503
Honolulu, HI 96822

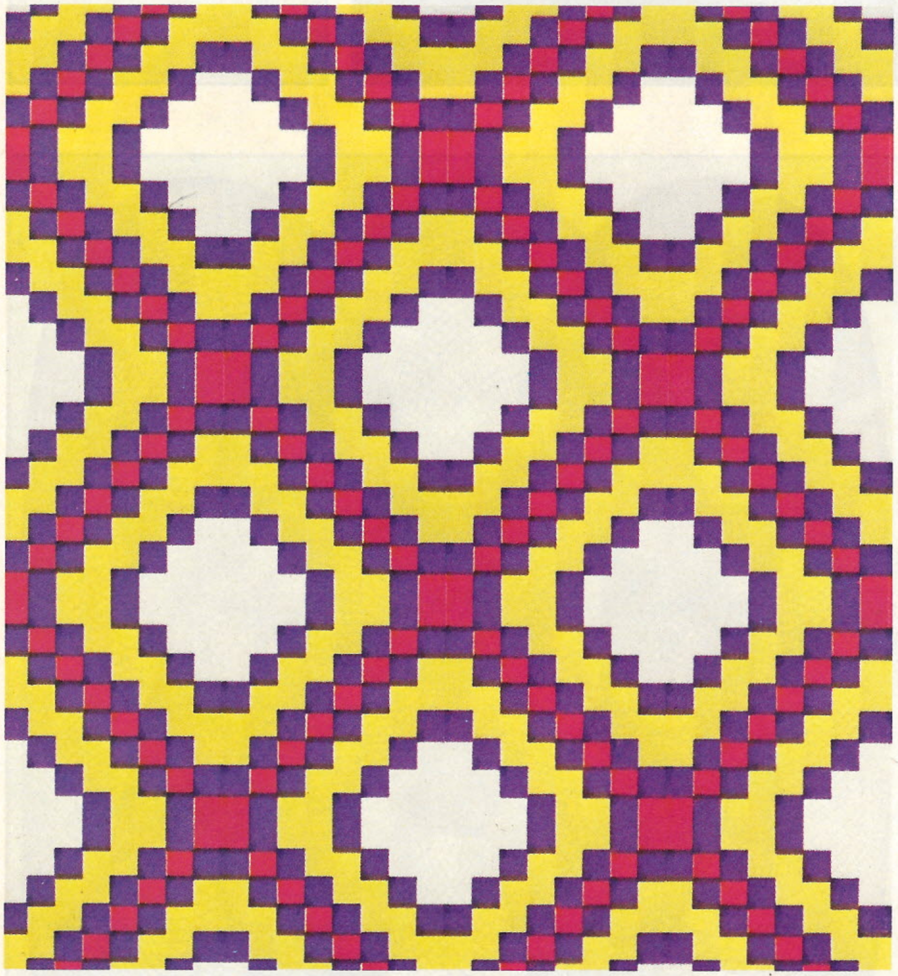


Houndstooth Variation 2

Printer Hard Copy

Created on a CCS 2210 microcomputer and MicroAngelo video board, and produced by an Axiom 820 printer. *Second.*

Mel Cobb
1520 Ward Ave., #503
Honolulu, HI 96822

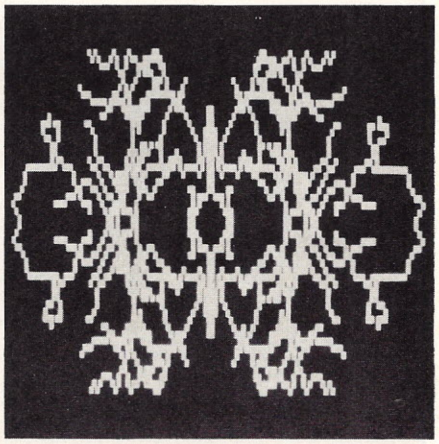


Design 12 in 3 Colors

Plotter Hard Copy

Produced on a 48K TRS-80 Model I and a Watanabe WX4671 plotter. *Third.*

William Shotts, Jr.
Box 143
Sandy Springs, MD 20860



Designs

Black & White Video

A video display produced from TRS-80 Model I Level II output.

Alan Hensel
RD #1, Box 184-A
Cranbury, NJ 08512

What has nine lives, three forms, multiple faces and a price tag that almost disappears?

The Magical Microline 80 Printer

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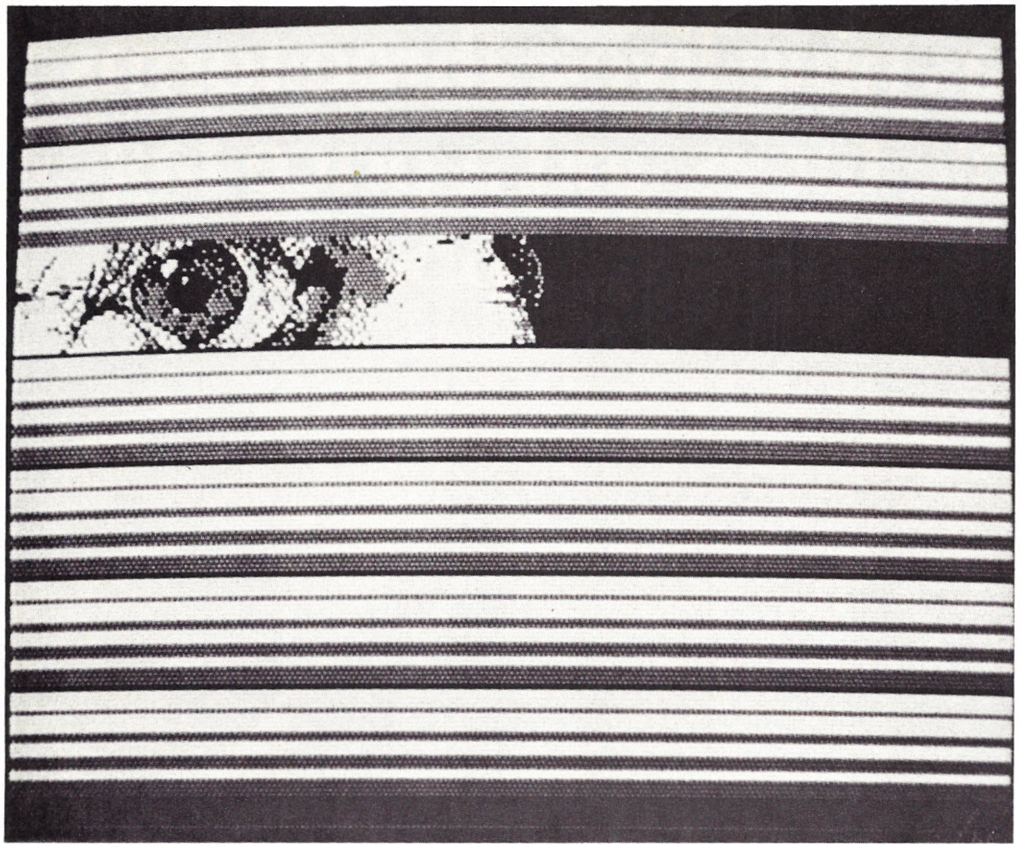
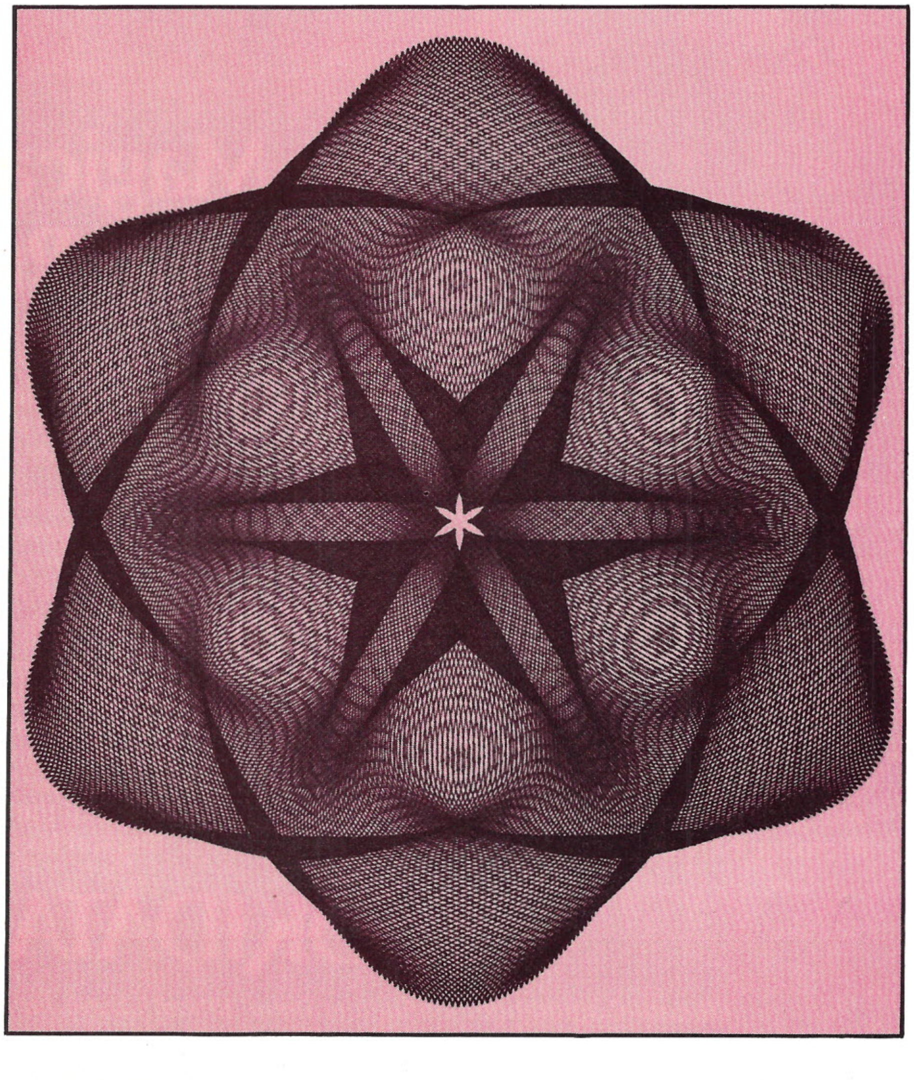


Icy Freeway

Black & White Video

Produced on a TRS-80 Model I with EDTASM and a GRAFIX80 high resolution graphics board, using Programma International's Create program, by Ted Carter. *First.*

Theadore D. Warnell
2511 15A St., S.W.
Calgary, Alberta T2T 4B8
Canada

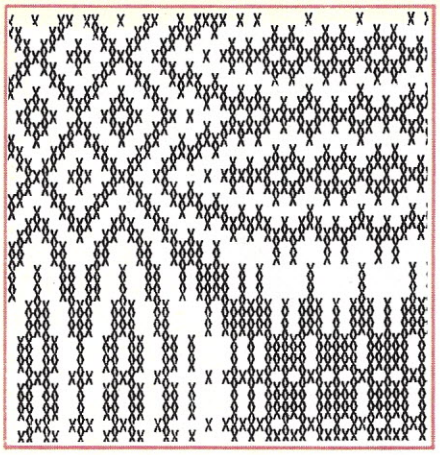


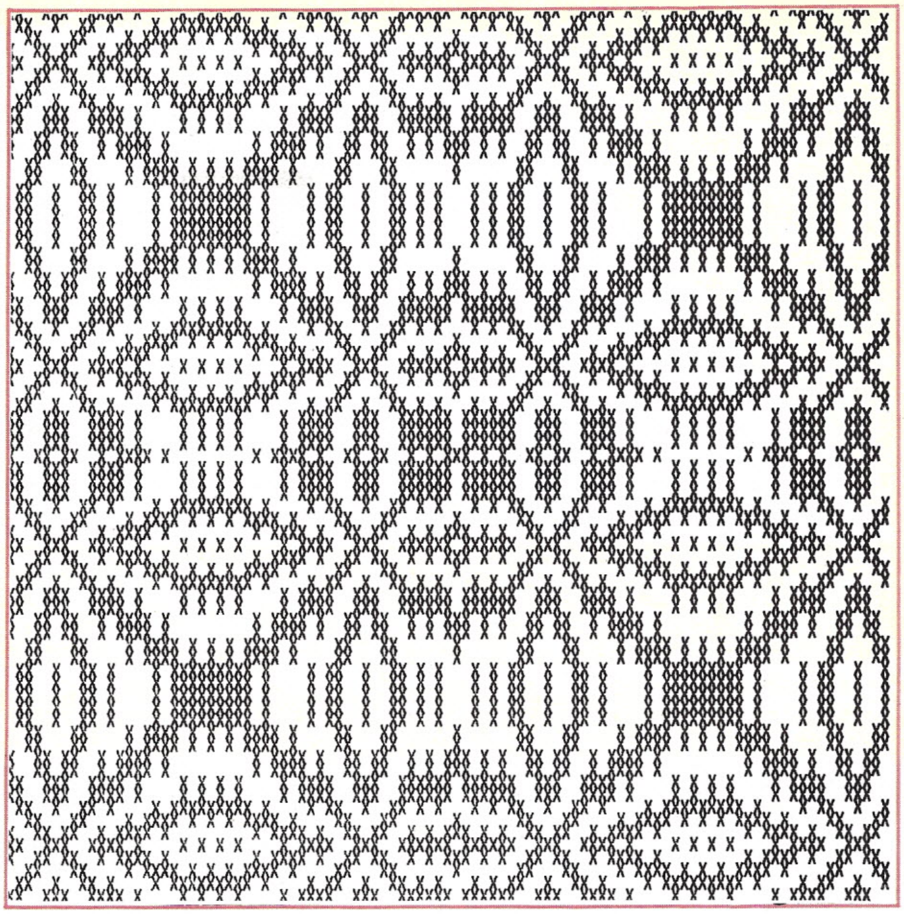
Rosette Variation 6

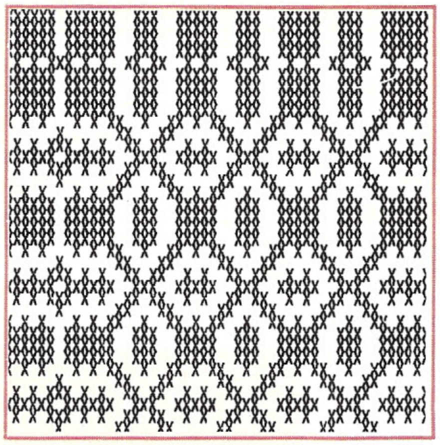
Plotter Hard Copy

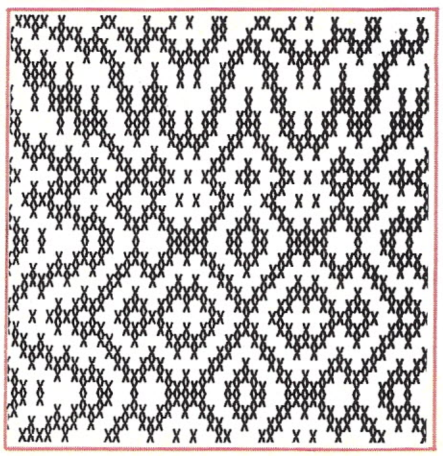
Produced on a Terak 8510A microcomputer and Hewlett-Packard 7225A plotter, using UCSD Pascal. *First.*

Mel Cobb
1520 Ward Ave., #503
Honolulu, HI 96822







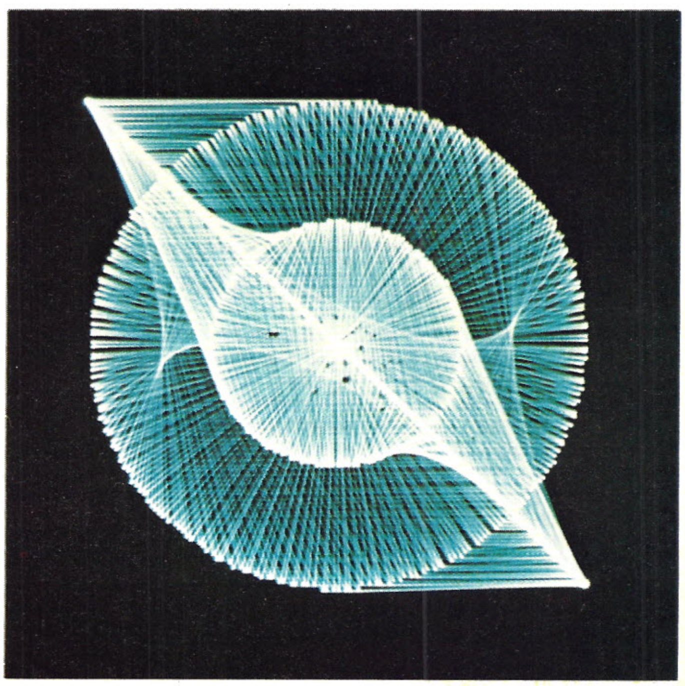


Handweavers Graphic Patterns

Printer Hard Copy

Produced with an SWTP 6809 microcomputer and DecWriter LA34 printer. The pattern derives from a warp and weft draft in *A Handweaver's Pattern Book* by Marguerite Porter Davison. *First.*

Laird D. Schearer
207 Lovers Lane
Rolla, MO 65401

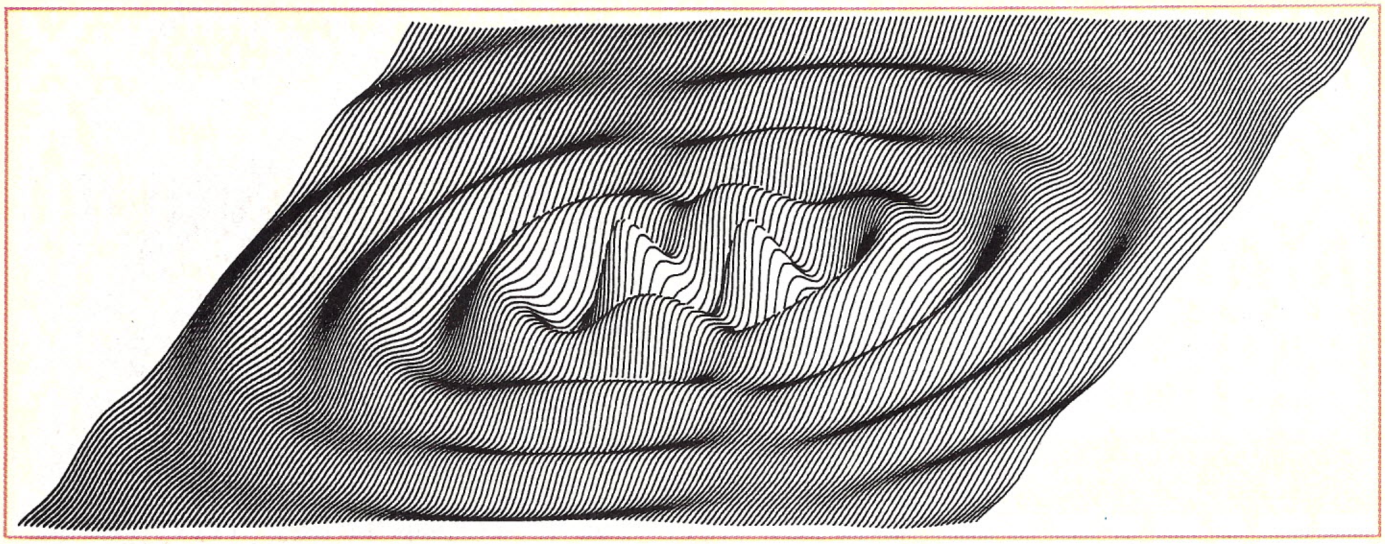


Fibers

Black & White Video

Created on a home-brew 6800-based 8K system. The vector-type video display is made from a television with its deflection coils driven by a home-brew current driver.

Larry Abel
91 Forrest Ave.
Fairfax, CA 94930

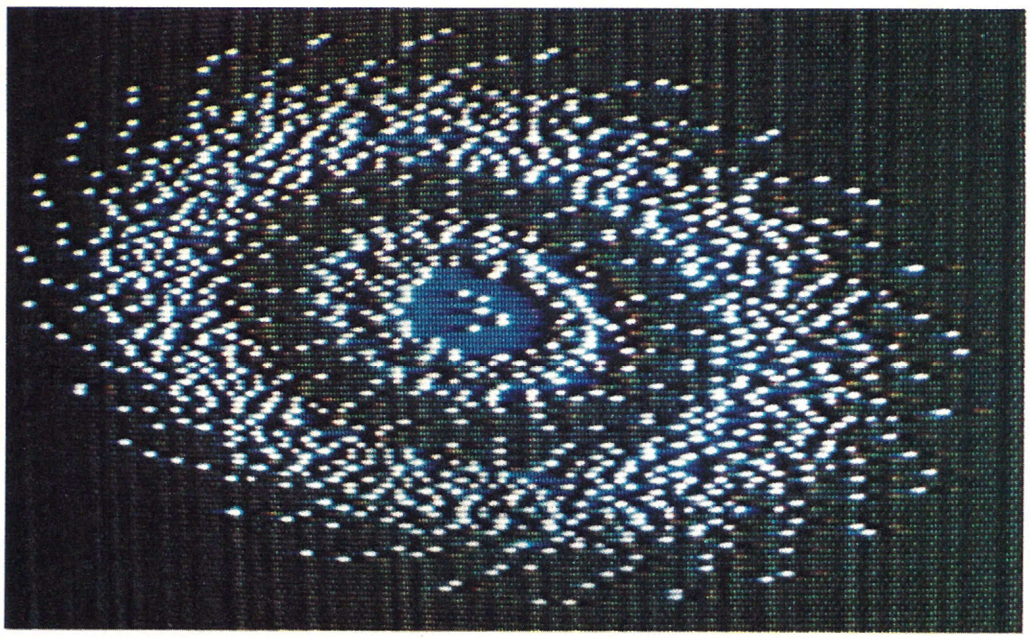


Interference Patterns

Plotter Hard Copy

Produced on an 8080 microprocessor-controlled Wang 2272 drum plotter. The plotter was driven by a privately-modified Wang OIS workstation. *Second.*

Larry Hamilton
PO Box 2013
Lowell, MA 01851



Galaxy

Color Video

Created on an SWTP 6809 microcomputer with Percom's Electric Crayon. This is one frame of a real-time animation program. *Second.*

Ted Wolff
579 W. 215th St.
New York, NY 10034

BASIC subroutines allow you to reformat TRS-80 graphics for display on the H19 terminal.

TRS-80 Graphics On the Heath H19

By D. C. Shoemaker

Heath's H19 terminal or H89 computer handles graphics differently from the TRS-80. For three years, this fact frustrated many of my attempts to run TRS-80 programs on my H8. But I've finally decided to do something about it.

The charts in Fig. 1 should make clear what the relationships are between the TRS-80 graphics system coordinates and those of the H19. Using this relationship, it's relatively easy to create the algorithms used in the five demonstration programs that follow.

The major difficulty with the conversion is the way the TRS-80 subdivides each character position. Under normal circumstances, the H19 treats each character position as an indivisible unit, so certain allowances must be made for a degree of coarseness in the H19 display that would not be found in the TRS-80 when using the SET X,Y commands. You can avoid this, but you need a special disk-based device driver and a new ROM chip, available from Micro Interface, Inc. (Box 14520, Minneapolis, MN 55414). This is a more sophisticated approach, and I won't pursue it here except to say that it is definitely worth the $49.95 it cost. But it's not required for our purposes.

The Programs

The five programs presented here are largely self-explanatory. They will run under almost any version of Microsoft BASIC, under Heath's own Benton Harbor BASIC or under almost any other type of extended BASIC, whether tape, disk or ROM-based.

Some comments on how the program in Listing 1 works will help the understanding of the others. Lines 110 and 120 are the two conversion routines that take the TRS-80 screen

Listing 1. Subroutine to demonstrate TRS-80 PRINT@ command.

```
10 REM            GRAPHICS CONVERSION SUBROUTINE NUMBER 1
20 :
30 REM THIS ROUTINE CONVERTS TRS-80 SCREEN LOCATIONS TO X,Y COORDINATES
40 REM FOR DIRECT USE BY THE H19.  THIS IS A DEMONSTRATION OF THE
50 REM "PRINT AT" COMMAND.
60 :
70 PRINTCHR$(27);"F":REM SELECT GRAPHICS MODE
80 PRINTCHR$(27);"x5":REM CURSOR OFF
90 PRINTCHR$(27);CHR$(69);:REM ERASE SCREEN
100 INPUT"WHAT IS THE TRS-80 SCREEN LOCATION NUMBER";N
110 X=(N-(INT(N/64)*64)+1)
120 Y=INT(N/64)+1
130 AX=X+31:AY=Y+31:REM ADD ANY DESIRED OFFSET TO THE DECIMAL VALUES
140 PRINT"X =";X;", Y =";Y;", A =";AX;" AND B =";AY
150 PRINTCHR$(27);CHR$(89);CHR$(AY);CHR$(AX);"i"
160 PRINTCHR$(27);CHR$(72);:GOTO100
```

Listing 2. Subroutine to demonstrate TRS-80 SET and RESET commands.

```
10 REM            GRAPHICS CONVERSION SUBROUTINE NUMBER 2
20 :
30 REM THIS ROUTINE CONVERTS TRS-80 SCREEN LOCATIONS TO X,Y COORDINATES
40 REM FOR DIRECT USE BY THE H19.  IT ALSO DEMONSTRATES HOW TO "RESET"
50 REM THE LOCATION JUST "SET."  X & Y ARE THE TRS-80 COORDINATES, AND A & I
60 REM ARE THE H19 COORDINATES.
70 :
80 PRINTCHR$(27);"F":REM SELECT GRAPHICS MODE
90 PRINTCHR$(27);"x5":REM CURSOR OFF
100 PRINTCHR$(27);CHR$(69);:REM ERASE SCREEN
110 INPUT"WHAT IS THE TRS-80 SCREEN LOCATION NUMBER";N
120 X=(N-(INT(N/64)*64)+1):Y=INT(N/64)+1:AX=X+31:AY=Y+31
130 PRINT"X =";X;", Y =";Y;", A =";AX;" AND B =";AY
140 PRINTCHR$(27);CHR$(89);CHR$(AY);CHR$(AX);"i"
150 FOR I=1TO300:NEXT I
160 PRINTCHR$(27);CHR$(89);CHR$(AY);CHR$(AX);" "
170 PRINTCHR$(27);CHR$(72);:GOTO110
```

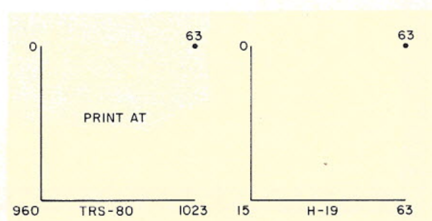


Fig. 1. The relationship between the TRS-80 format and that of the H19. The numbers represent the coordinates of a plotted point.

Address correspondence to D. C. Shoemaker, 2000 A Foxridge, Blacksburg, VA 24060.

location that would be given in the PRINT or PRINT AT command, and change it into two coordinates that the H19's Z-80 can make use of to control the cursor. Line 130 completes the process by adding the necessary offset to begin the plot at the upper-left edge of the screen.

The H19 manual explains why this is necessary, for those of you who want to pursue that. It's clear that any desired offset could be added here, for instance, to center the TRS-80 part of the display on the H19's screen. (That was actually done in the program in Listing 3; see line 100.) At the end of line 150, the "i" in quotes is merely a graphics character (a block) used for demonstration purposes. Naturally, it could be any of the other available characters.

The program in Listing 2 is based on its forerunner, but shows how the illuminated or SET point may be reset or erased by the same method. A delay is inserted in line 150 to make it easier to observe the effect on the screen.

Listing 3 is a program to outline the area of the TRS-80 screen superimposed on the H19 screen. Aside from a demonstration of the plotting technique, it may help in centering the otherwise offset graphics of whatever program you might be converting.

The program in Listing 4 illustrates how to handle the SET X,Y command when you won't be using the PRINT AT type of command. Line 120 is the conversion, and here, too, any desired offset may be used. Listing 5 is an extension of this, included to show one way to reset the point just set. Again, a delay is built into the subroutine at line 170.

Conclusions

You should now have a good idea how to go about converting those tantalizing TRS-80 programs into something your H19 can use. And if you have some other type of addressable-cursor terminal, you may find that the same approach will produce useful results.

Remember that this technique will not necessarily duplicate the speed of response of a memory-mapped video display such as the TRS-80 has, but at the normal H19 baud rate of 9600, the results are impressive. And think of all those programs you can now enter and run. ■

Listing 3. Demonstration of the area of the TRS-80 screen superimposed on the H19 screen, for comparison of relative locations.

```
10 REM            GRAPHICS CONVERSION SUBROUTINE NUMBER 3
20 :
30 REM THIS ROUTINE BLOCKS OUT THE AREA THE TRS-80 SCREEN REPRESENTS ON
40 REM THE H19 SCREEN.
50 :
60 PRINTCHR$(27);"F":REM SELECT GRAPHICS MODE
70 PRINTCHR$(27);"x5":REM CURSOR OFF
80 PRINTCHR$(27);CHR$(69);:REM ERASE SCREEN
90 PRINTCHR$(27);CHR$(72);:REM HOME CURSOR
100 FOR J=0 TO 1023:N=J
110 X=(N-(INT(N/64)*64)+1):Y=INT(N/64)+1:AX=X+38:AY=Y+34
120 PRINTCHR$(27);CHR$(89);CHR$(AY);CHR$(AX);"i"
130 NEXT J:PRINT:PRINTTAB(16);"THIS IS THE SCREEN AREA USED BY ";@
        "TRS-80 PROGRAMS.":END
```

Listing 4. This subroutine demonstrates the TRS-80 SET X,Y command.

```
10 REM            GRAPHICS CONVERSION SUBROUTINE NUMBER 4
20 :
30 REM THIS ROUTINE CONVERTS TRS-80 SCREEN LOCATIONS TO X,Y COORDINATES
40 REM FOR DIRECT USE BY THE H19.  THIS IS A DEMONSTRATION OF THE
50 REM "SET X,Y" COMMAND.
60 :
70 PRINTCHR$(27);"F":REM SELECT GRAPHICS MODE
80 PRINTCHR$(27);"x5":REM CURSOR OFF
90 PRINTCHR$(27);CHR$(69);:REM ERASE SCREEN
100 INPUT"WHAT ARE THE TRS-80 SET/RESET COORDINATES";X,Y
110 REM ADD ANY DESIRED OFFSET TO 31 IN LINE 120
120 AX=INT(X/2)+31:AY=INT(Y/2)+31
130 REM X & Y ARE THE H19 COORDINATES
140 PRINT"X =";AX;" AND Y =";AY
150 PRINTCHR$(27);CHR$(89);CHR$(AY);CHR$(AX);"i";
160 PRINTCHR$(27);CHR$(72);:GOTO100
```

Listing 5. Subroutine to demonstrate the difference in resolution between the H19 and the TRS-80.

```
10 REM            GRAPHICS CONVERSION SUBROUTINE NUMBER 5
20 :
30 REM THIS ROUTINE CONVERTS TRS-80 SCREEN LOCATIONS TO X,Y COORDINATES
40 REM FOR DIRECT USE BY THE H19.  THIS IS A DEMONSTRATION OF THE
50 REM "SET X,Y" AND "RESET X,Y" COMMANDS.  NOTE THAT DUE TO COARSER
60 REM RESOLUTION, ONLY EVEN-NUMBERED TRS-80 COORDINATES PLOT ON THE H19.
70 :
80 PRINTCHR$(27);"F":REM SELECT GRAPHICS MODE
90 PRINTCHR$(27);"x5":REM CURSOR OFF
100 PRINTCHR$(27);CHR$(69);:REM ERASE SCREEN
110 INPUT"WHAT ARE THE TRS-80 SET/RESET COORDINATES";X,Y
120 REM ADD ANY DESIRED OFFSET TO 31 IN LINE 130
130 AX=INT(X/2)+31:AY=INT(Y/2)+31
140 REM X & Y ARE THE H19 COORDINATES
150 PRINT"X =";AX;" AND Y =";AY
160 PRINTCHR$(27);CHR$(89);CHR$(AY);CHR$(AX);"i";
170 FOR I=1TO300:NEXT I
180 PRINTCHR$(27);CHR$(89);CHR$(AY);CHR$(AX);" ";
190 PRINTCHR$(27);CHR$(72);:GOTO110
```


✓See List of Advertisers on page 194

At last, black and white, 256 × 256 pixel graphics as good as any—and it doesn't eat up memory space.

6800 High-Speed, High-Resolution Graphics

By Terry Mayhugh

Although the 6800 community has been blessed with both high-quality hardware and software, high-resolution graphics—standard in many other all-in-one computers—has been practically nonexistent. The economical SWTP GT-6144 board was a step in the right direction a few years ago, but the 96 × 64 resolution is poor by today's standards.

A 256 × 256 display, on the other hand, is quite adequate for most purposes. For plotting it offers a resolution better than .4 percent full scale; and, of course, for games and animation this order of resolution has been shown to be quite adequate. Any 6800 owner who has seen some of the intricate high-res games running on the Apple's 280 × 190 display must surely long for similar capability.

The Electric Crayon by Percom, with its own on-board 6802 microprocessor and nine resolution modes (highest is 256 × 192 with a single color available) sounded exactly like what I wanted. After receiving the unit and interfacing it to my SWTP 6800, however, I sadly discovered that although it was fine for plotting, its excruciatingly slow speed makes animation and rapidly moving games impossible.

The EGOS operating system, which comes with the unit, is so cumbersome that, once the computer transmits the starting point and length of a 256-pixel horizontal line to be plotted in the high-res mode, the unit requires about two seconds to draw it. (The line drawing routines handle horizontal and vertical lines only.) Although provision has been made to let the user install his own operating system, I was not able to improve on the speed by much more than a factor of 5 or 6 without creating objectionable display flicker.

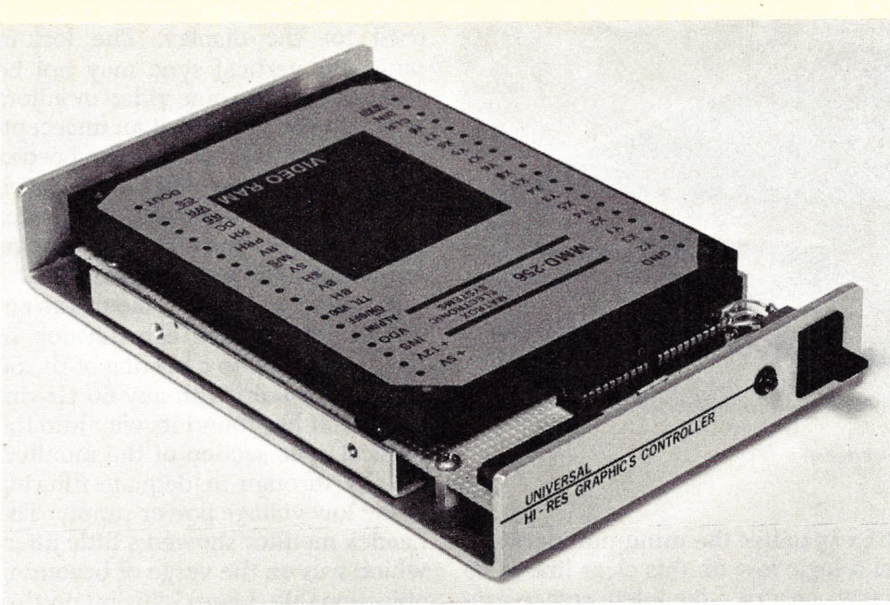
However, even improving the speed by a factor of 10 wouldn't put this unit in the proverbial ball park.

I still like the concept, though, of communicating with the display RAM through an I/O port as the Crayon does. Although certainly not optimum for highest operating speed, precious computer memory (8K for 256 × 256 display) is not robbed for use by the video display. This philosophy allows the CPU to effectively control more than 64K of memory.

After coming across the MMD256D CRT controller module manufactured by Matrox (5800 Andover Ave., Montreal, Quebec H4T 1H4), I decided to put together my own system—both the hardware and software. Since this module has a worst case access time of 2 us per pixel, the controller would certainly not limit the speed of my display. An inspection of the data sheet, however, revealed that the unit would not simply "bolt on" to a single parallel port, and I would be on my own to come up with the software for the graphics commands.

The MMD256D CRT controller. (Photos by Steve Hall)

Address correspondence to Terry Mayhugh, 11632 Midhurst Drive, Concord, TN 37922.



An inside look of the graphics controller.

The projected results, however, would be well worth the effort. I would have a high-speed, high-resolution display which does not use computer memory and, except for a lack of color, would perform as well as anything available with the appliance-type computer.

Hardware Requirements

The Matrox module is a complete graphics CRT display controller with a composite video output capable of driving any standard TV monitor. This unit, in conjunction with a high-resolution monitor such as the Leedex Video 100, gives a beautiful, high-quality display. It contains the necessary sync and video generators, 8K of refresh memory and sufficient electronics to interface to a 16-bit computer bus or multiple (at least 3) eight-bit parallel I/O ports. However, to interface it to a single Southwest Tech MPLA card, some additional electronics is required, including a minor modification to the I/O card itself. Fortunately, due to the high-speed access time of the controller, these additional interface requirements are minimal.

First, the eight A-side lines of the MPLA card must be configured for computer output. This is easily done with the OA board jumper as described in the MPLA assembly instructions. The B-side, however, should be configured for computer output on the four most significant bits and for computer input on the four least significant bits. Actually, only computer input line PB0 is really used; but the modification is most easily done for lines in groups of four.

To do this, the IB jumper should be installed to set up the B-side of the PIA for computer input of all eight lines. Then the two traces on the rear of the board leading to pins 7 and 9 of IC3 should be cut with an X-acto knife as close as possible to the IC pins. Pin 9 must next be connected to ground (a convenient point is pin 8 of IC3), and pin 7 should be connected to +5 V through a 4.7k resistor (a convenient point for this connection is pin 16 of IC3).

This board modification reverses the direction of the Tri-state transceivers for bits PB4 through PB7. As you will see later, the internal registers of the PIA must also be properly configured with an appropriate software initialization routine. Handshake lines CA2 and CB2 are used in this application as additional computer output lines; this is standard for this I/O card.

I should mention here that there is an error in the schematic included with the MPLA assembly instructions concerning IC7, which contains the CA2 and CB2 line drivers. Pin 9 of this IC is actually connected to +5 V through a 4.7k resistor as required to set up the CA2 and CB2 lines as outputs and the CA1 and CB1 lines as inputs. The schematic provided by SWTP erroneously shows pin 7 grounded, although the board layout is correct.

The schematic in Fig. 1 shows the additional interface hardware required: two 74LS374 eight-bit latches, two 7402 quad NOR gate packages used for logic steering and a 7474 D flip-flop used as a single bit latch. Lines PA0 through PA7 parallel-feed the D inputs of both eight-bit latches, which are used as the pixel X,Y coordinate registers. Under computer control, line PB6 steers the CB2 strobe to the appropriate register so that the X and Y coordinates of the pixel are properly loaded and presented to the CRT controller prior to a read or write operation.

When a computer line PB6 makes a low-to-high transition, CB2 strobes the address information from the

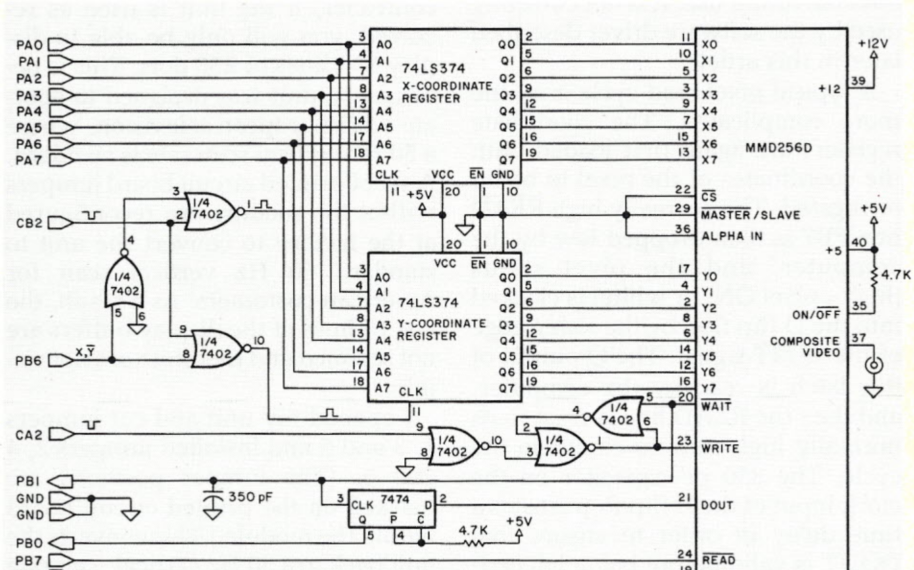


Fig. 1. High-resolution graphics controller schematic.

Back view of the controller.

A-side of the PIA into the X coordinate register. Conversely, a high-to-low transition of PB6 loads the PIA A-side data into the Y coordinate register.

To write to a pixel, its X and Y coordinates are first loaded into the two registers. The DIN input bit (line PB5) is set for the desired color, either white or black; then a dummy READ PIA A-side instruction is executed so that CA2 toggles the $\overline{\text{WRITE}}$ input to the MMD-256D low. A $\overline{\text{WAIT}}$ low signal is issued from the module which latches $\overline{\text{WRITE}}$ to a low state until the module's internal write cycle is completed, and the pixel has been written.

The worst case 2 us access time of the module is so fast that for typical micro applications no computer handshake is required. As can be seen from the schematic, the $\overline{\text{WAIT}}$ is also sent to the computer via PB1 for possible future use. It is not currently used by the software driver described later in this article.

A typical pixel read cycle is a little more complicated. The coordinate registers are again first loaded with the coordinates of the pixel to be interrogated. The normally high $\overline{\text{READ}}$ line PB7 is then dropped low by the computer, and the pixel status (high = pixel ON, or white) is clocked into the D flip-flop by the rising edge of the $\overline{\text{WAIT}}$ signal. The Q output of this latch is read by the computer, and then the $\overline{\text{READ}}$ line is reset to its normally high state to complete the cycle. The 350 pF capacitor on the clock input of the D flip-flop creates a time delay in order to ensure that DOUT is valid before being latched.

The $\overline{\text{CLR}}$ line PB4 is an asynchronous input to the controller module, which unconditionally sets all 65,536 pixels either white or black, depending on the status of the DIN line. Matrox specifies the minimum duration of a logic low on this clear line at 40 ms to ensure a complete screen erasure. A software timing loop may be fine-tuned to accomplish this.

The controller itself requires two regulated power supplies: +5 V at 400 mA and +12 V at 100 mA. This additional 5-volt load can be comfortably handled by the 5-volt regulator on board the MPLA card. A small heatsink fashioned from a 1 inch by 2 inch piece of copper sheet bent in the shape of an L and placed under the regulator IC will provide some additional cooling. The 12-volt power can also, in most cases, be obtained from the computer. A Fairchild 7812 three-terminal regulator IC can be used to drop the computer's unregulated 14–16 V line down to 12 V for use by the module.

Although Matrox specifies the MMD256D to be a 256×256 pixel controller, if the unit is used as received, you will only be able to display 240 lines of 256 dots. This is because the unit was designed to operate with European television, where a 50 Hz vertical scan rate is standard. A set of printed circuit board jumpers within the module are reconfigured at the factory to convert the unit to standard 60 Hz vertical scan for American customers. As a result, the last 15 lines of the display buffers are not scanned and therefore are not visible.

I opened my unit and cut jumpers 1, 3 and 5 and installed jumpers 2, 4 and 6. (The jumper positions are marked on the printed circuit board within the module.) This converts the unit back to a 50 Hz vertical scan rate and restores the display to 256×256 pixels.

In general, however, two possible problems can result from this modification, depending on the monitor used for the display. The lock-in range for vertical sync may not be wide enough in some video monitors to include 50 Hz so that an unacceptable vertical roll results. The Leedex Video 100 monitor that I use is specified to lock onto vertical scan rates between 45 Hz and 60 Hz, and so this did not become a problem for me.

A second possible problem is an annoying jitter which can develop in the display due to a beating of the 50 Hz vertical scan with any 60 Hz ripple which has found its way into the vertical sync section of the monitor, usually through inadequate filtering in the low voltage power supply. The Leedex monitor showed a little jitter, which was on the verge of becoming objectionable. I cured this by putting an additional 20,000 pF capacitor across the low voltage regulated output. If you don't wish to perform these modifications to the module or monitor, the unit will work fine in the 240×256 mode.

Software Driver

No peripheral is useful without good control software, and so I wrote a driver package to control this SWPT6800/MMD256D combination. Five high-level commands, INITG, ERASE, READ, DOT and VECTOR, are provided to allow high-level graphics control from a machine language program or through a BASIC interpreter using the CALL or USER functions.

The 13-byte scratchpad area has been ORGed at location $0000 to take advantage of the 6800's zero page addressing mode. For historical reasons, most 6800 BASIC interpreters do not use the first 32 bytes of page 0, and so this should not create any conflicts. The driver routines themselves are ORGed at $A100, but they can be relocated to any other convenient area in your computer's memory

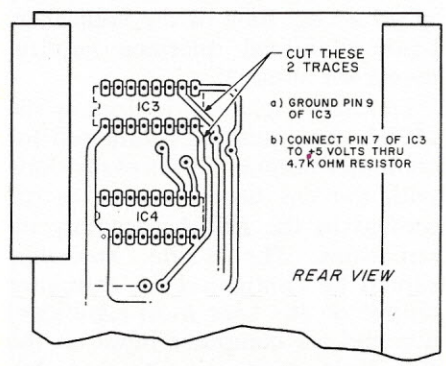


Fig. 2. MPLA board modifications.

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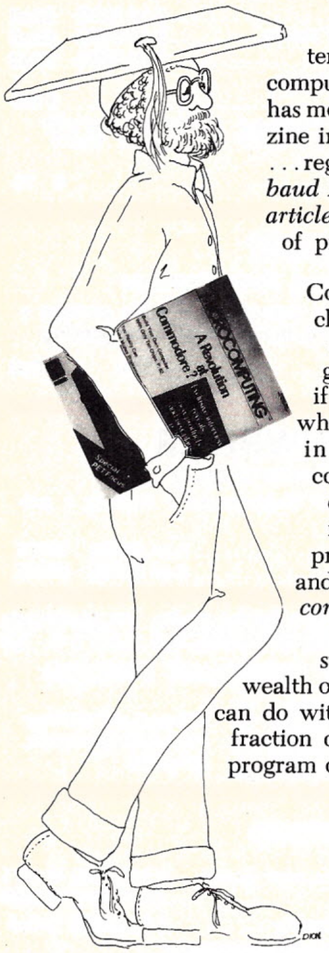

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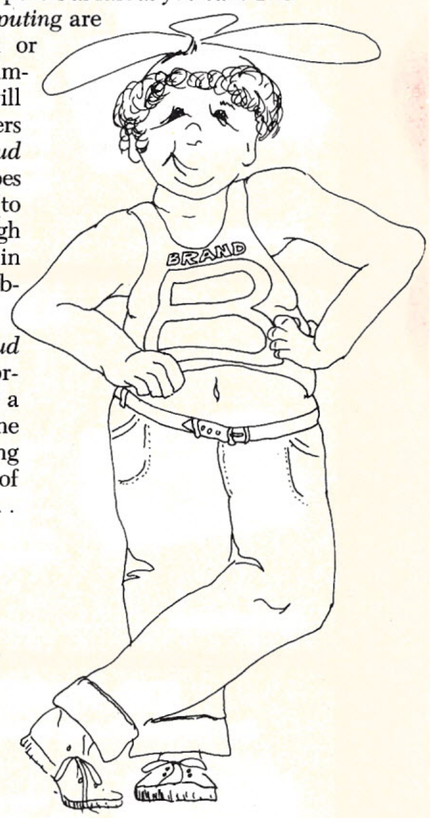

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map to avoid possible problems with any coresident software.

The COLOR register contains the color in present use, either black or white, and is accessed by the ERASE, DOT and VECTOR routines. This byte must be reloaded (or poked in BASIC) with a new color byte only when it is to be changed. This byte is masked before it is used by any of the subroutines so that only bit 5 is read. This prevents accidental bombing of the driver when illegal color bytes are loaded and allows interesting even/odd effects to be easily plotted.

The PIXEL register contains the status of the pixel which has been most recently read. This byte may be tested (or peeked, if in BASIC) to determine the pixel status. The X1, Y1 registers define the current coordinates of the cursor. The X2, Y2 register pair contains the end point coordinates of the most recently defined vector or line and is accessed by the VECTOR drawing routine.

The INITG routine must be executed once at the beginning of your program before any of the other graphics subroutines are called. This routine clears the entire video display to all black, sets COLOR to white, and places the cursor at (0,0).

The controller software is written so that the origin (0,0) is sensibly located at the lower left-hand side of the display. This corresponds to the location of the origin in the familiar Cartesian coordinate system. If you wish, instead, to place the origin at the upper left-hand corner to maintain compatibility with most other micrographics systems, then you must NOP the bytes at labels ORD1 through ORD5.

The ERASE routine may be called anytime you wish to clear the screen to a single color. Bit 5 of the byte in the COLOR register must be properly set (white = 1 or black = 0) before this command is used. The execution time for this routine is about 40 ms, which is the minimum clear pulse width specified for the module. You can experiment with the software timing loop within this subroutine to even further minimize this execution time for your particular module.

The READ routine is called when you wish to interrogate a particular pixel to determine its present color. The cursor is first set over the pixel by appropriately loading the X1, Y1 registers; then this subroutine is called. When the READ cycle is completed the pixel status will reside in the PIXEL register (white = $01 and black = $00). This routine requires approximately 60 machine cycles for execution, which corresponds to about 45 us per read on a 1.3 MHz computer.

Software driver in 6800 BASIC.

```
                 ***********************************************************************
                 *                              MTROX1                                 *
                 *                 HI-RES GRAPHICS CONTROLLER DRIVER                   *
                 *      for SWTP 6800 microcomputer interfaced to Matrox MMD-256D      *
                 *                          Terry L. Mayhugh                           *
                 ***********************************************************************

                 * Timing loop is initialized for a 1.3 MHz CPU clock.
                 * Origin (0,0) located at lower left corner of display.
                 * To relocate origin to upper left corner, NOP bytes at labels
                 * ORD1 through ORD5.

8018             PIA1AD EQU   $8018        PIA Port number 6
801A             PIA1BD EQU   PIA1AD+2

0000                    ORG   $0000

                 *      Scratchpad area for controller driver
0000             COLOR  RMB   1            Color Register: bit 5=1 for white, bit 5=0 for black
0001             PIXEL  RMB   1            Result of pixel read:  White=$01  Black=$00
0002             X1     RMB   1            Cursor coordinates
0003             Y1     RMB   1            *
0004             X2     RMB   1            Endpoint coordinates of vector
0005             Y2     RMB   1            *
0006             DX     RMB   1            Vector routine temporaries
0007             DY     RMB   1            *
0008             X1LOAD RMB   1            *
0009             Y1LOAD RMB   1            *
000A             XDIFF  RMB   1            *
000B             YDIFF  RMB   1            *
000C             SLOPE  RMB   1            *
000D             TEMPIX RMB   2            Index register temporary storage

A100                    ORG   $A100

                 *      Interface Initialization Command
                 *      Screen is cleared to all black.
                 *      Cursor is set to origin (0,0).
                 *      COLOR is set to white before exiting.
A100 CE 8018     INITG  LDX   #PIA1AD
A103 6F 01              CLR   1,X
A105 6F 03              CLR   3,X
A107 6F 00              CLR   0,X
A109 6F 02              CLR   2,X
A10B 63 00              COM   0,X          all outputs on A-side of PIA
A10D 86 F0              LDA A #%11110000   4 outputs, 4 inputs on B-side of PIA
A10F A7 02              STA A 2,X          PB7=READ'     PB6=X/Y'
                 *                         PB5=color     PB4=CLEAR'
                 *                         PB1=WAIT'     PB0=pixel
A111 86 2E              LDA A #%00101110
A113 A7 01              STA A 1,X          config. CA2 as WRITE' strobe
A115 A7 03              STA A 3,X          config. CB2 as coordinate strobe
```

More →

Listing continued.

```
A117 7F 0000            CLR    COLOR         set COLOR to black for initial screen erase
A11A 7F 0002            CLR    X1            home to (0,0)
A11D 7F 0003            CLR    Y1            *
A120 8D 05              BSR    ERASE         clear screen
A122 86 20              LDA A #$20
A124 97 00              STA A COLOR          initialize COLOR=white
A126 39                 RTS

                 *      Erase Screen Command
                 *      All pixels are written with color residing in COLOR register.
                 *      Subroutine requires 40 msec per erase.
A127 96 00       ERASE  LDA A COLOR          pick up color bit
A129 84 20              AND A #%00100000     mask off color bit
A12B 8B 80              ADD A #%10000000
A12D B7 801A            STA A PIA1BD         pull CLEAR' line low
A130 DF 0D              STX    TEMPIX        push index register
A132 CE 1970            LDX    #$1970        40 msec ERASE interval
A135 09          HOLDIT DEX
A136 26 FD              BNE    HOLDIT
A138 8B 10              ADD A #%00010000     restore CLEAR' line high
A13A B7 801A            STA A PIA1BD
A13D DE 0D              LDX    TEMPIX        pull index register
A13F 39                 RTS

                 *      Read Pixel at (X1,Y1) Command
                 *      Status of pixel is stored in PIXEL register.
                 *      Status also available in A accumulator upon exit.
                 *      White=1     Black=0
                 *      Subroutine requires 61 machine cycles per read
A140 96 03       READ   LDA A Y1
A142 43          ORD1   COM A                reverse ordinate
A143 B7 8018            STA A PIA1AD         load Y1 coordinate
A146 C6 90              LDA B #%10010000
A148 F7 801A            STA B PIA1BD         strobe in Y1 coordinate
A14B 96 02              LDA A X1
A14D B7 8018            STA A PIA1AD         load X1 coordinate
A150 CB 40              ADD B #%01000000
A152 F7 801A            STA B PIA1BD         strobe in X1 coordinate
A155 C4 70              AND B #%01110000
A157 F7 801A            STA B PIA1BD         toggle READ' line low
A15A B6 801A            LDA A PIA1BD
A15D 84 01              AND A #%00000001     mask pixel bit
A15F 97 01              STA A PIXEL          store the pixel bit
A161 CB 80              ADD B #%10000000
A163 F7 801A            STA B PIA1BD         restore READ' line
A166 39                 RTS
                 *      Write Pixel at (X1,Y1) Command
                 *      Pixel is written according to present COLOR contents.
                 *      Subroutine requires 46 machine cycles per write
A167 D6 02       DOT    LDA B X1
A169 F7 8018            STA B PIA1AD         load X1 coordinate
A16C 96 00              LDA A COLOR          pick up color byte
A16E 84 20              AND A #%00100000     mask off color bit
A170 8B D0              ADD A #%11010000
A172 B7 801A            STA A PIA1BD         strobe in X1 coordinate
A175 D6 03              LDA B Y1
A177 53          ORD2   COM B                reverse ordinate
A178 F7 8018            STA B PIA1AD         load Y1 coordinate
A17B 84 B0              AND A #%10110000
A17D B7 801A            STA A PIA1BD         strobe in Y1 coordinate
A180 F6 8018            LDA B PIA1AD         pulse WRITE' line
A183 39                 RTS

                 *      High Speed Vector Generator from (X1,Y1) to (X2,Y2) Command
                 *      Update (X2,Y2) before entry.
                 *      (X1,Y1) pair is automatically updated to (X2,Y2) before exit.
                 *      Subroutine requires an average set-up and exit overhead of 100 machine
                 *      cycles per vector along with an average 70 cycles per pixel per vector.
                 *      Fast exit for vertical and horizontal line is provided.
A184 C6 01       VECTOR LDA B #1             initialize increment registers
A186 D7 06              STA B DX             *
A188 D7 07              STA B DY             *
A18A 7F 000C            CLR    SLOPE         clear slope register
A18D D6 00              LDA B COLOR          pick up color byte
A18F C4 20              AND B #%00100000     mask off color bit
A191 CB D0              ADD B #%11010000
A193 D7 08              STA B X1LOAD         strobe byte for X1 coordinate
A195 C4 B0              AND B #%10110000
A197 D7 09              STA B Y1LOAD         strobe byte for Y1 coordinate
A199 96 04       DELX   LDA A X2
A19B 44                 LSR A
A19C D6 02              LDA B X1
A19E 54                 LSR B
A19F 10                 SBA
A1A0 97 0A              STA A XDIFF          X distance/2 to move
A1A2 2C 06              BGE    POSX          X direction is east
A1A4 70 0006            NEG    DX            X direction is west
A1A7 70 000A            NEG    XDIFF         *
A1AA 26 03       POSX   BNE    DELY
```

More

Listing continued.

```
A1AC 73 000C   143:        COM   SLOPE      vertical movement only
A1AF 96 05     144: DELY   LDA A Y2
A1B1 44        145:        LSR A
A1B2 D6 03     146:        LDA B Y1
A1B4 54        147:        LSR B
A1B5 10        148:        SBA
A1B6 97 0B     149:        STA A YDIFF      Y distance/2 to move
A1B8 2C 06     150:        BGE   PLOT       direction is north
A1BA 70 0007   151:        NEG   DY         direction is south
A1BD 70 000B   152:        NEG   YDIFF      *
A1C0 96 0C     153: PLOT   LDA A SLOPE      initialize slope accumulator
A1C2 D6 02     154: WRTDOT LDA B X1 .
A1C4 F7 8018   155:        STA B PIA1AD     load X1 coordinate
A1C7 D6 08     156:        LDA B X1LOAD
A1C9 F7 801A   157:        STA B PIA1BD     strobe in X1 coordinate
A1CC D6 03     158:        LDA B Y1
A1CE 53        159: ORD3   COM B            reverse ordinate
A1CF F7 8018   160:        STA B PIA1AD     load Y1 coordinate
A1D2 D6 09     161:        LDA B Y1LOAD
A1D4 F7 801A   162:        STA B PIA1BD     strobe in Y1 coordinate
A1D7 F6 8018   163:        LDA B PIA1AD     pulse WRITE' line
A1DA D6 02     164:        LDA B X1
A1DC D0 04     165:        SUB B X2         X movement complete?
A1DE 27 49     166:        BEQ   CHECKY
A1E0 4D        167:        TST A
A1E1 2D 0A     168:        BLT   INCY
A1E3 D6 02     169:        LDA B X1
A1E5 DB 06     170:        ADD B DX
A1E7 D7 02     171:        STA B X1         update X1 coordinate register
A1E9 90 0B     172:        SUB A YDIFF      update slope accumulator
A1EB 20 D5     173:        BRA   WRTDOT
A1ED D6 03     174: INCY   LDA B Y1
A1EF DB 07     175:        ADD B DY
A1F1 D7 03     176:        STA B Y1         update Y1 coordinate register
A1F3 9B 0A     177:        ADD A XDIFF      update slope accumulator
A1F5 D1 05     178:        CMP B Y2         Y movement complete?
A1F7 26 C9     179:        BNE   WRTDOT
A1F9 D6 02     180:        LDA B X1
A1FB F7 8018   181:        STA B PIA1AD     load X1 coordinate
A1FE D6 08     182:        LDA B X1LOAD
A200 F7 801A   183:        STA B PIA1BD     strobe in X1 coordinate
A203 D6 03     184:        LDA B Y1
A205 53        185: ORD4   COM B            reverse ordinate
A206 F7 8018   186:        STA B PIA1AD     load Y1 coordinate
A209 D6 09     187:        LDA B Y1LOAD
A20B F7 801A   188:        STA B PIA1BD     strobe in Y1 coordinate
A20E F6 8018   189:        LDA B PIA1AD     pulse WRITE' line
A211 96 02     190: FINISX LDA A X1         dump slope, finish X movement
A213 9B 06     191:        ADD A DX
A215 97 02     192:        STA A X1         update X1 coordinate register
A217 D6 02     193:        LDA B X1
A219 F7 8018   194:        STA B PIA1AD     load X1 coordinate
A21C D6 08     195:        LDA B X1LOAD
A21E F7 801A   196:        STA B PIA1BD     strobe in X1 coordinate
A221 F6 8018   197:        LDA B PIA1AD     pulse WRITE' line
A224 90 04     198:        SUB A X2         X movement complete?
A226 26 E9     199:        BNE   FINISX
A228 39        200:        RTS
A229 96 03     201: CHECKY LDA A Y1         X movement is complete
A22B 91 05     202:        CMP A Y2         Y movement complete?
A22D 26 01     203:        BNE   FINISY
A22F 39        204:        RTS
A230 96 03     205: FINISY LDA A Y1         dump slope, finish Y movement
A232 9B 07     206:        ADD A DY
A234 97 03     207:        STA A Y1         update Y1 coordinate register
A236 D6 03     208:        LDA B Y1
A238 53        209: ORD5   COM B            reverse ordinate
A239 F7 8018   210:        STA B PIA1AD     load Y1 coordinate
A23C D6 09     211:        LDA B Y1LOAD
A23E F7 801A   212:        STA B PIA1BD     strobe in Y1 coordinate
A241 F6 8018   213:        LDA B PIA1AD     pulse WRITE' line
A244 90 05     214:        SUB A Y2
A246 26 E8     215:        BNE   FINISY     Y movement complete?
A248 39        216:        RTS
               217:        END
     NO ERROR(S) DETECTED

   SYMBOL TABLE:
CHECKY  A229    COLOR   0000    DELX    A199    DELY    A1AF
DOT     A167    DX      0006    DY      0007    ERASE   A127
FINISX  A211    FINISY  A230    HOLDIT  A135    INCY    A1ED
INITG   A100    ORD1    A142    ORD2    A177    ORD3    A1CE
ORD4    A205    ORD5    A238    PIA1AD  8018    PIA1BD  801A
PIXEL   0001    PLOT    A1C0    POSX    A1AA    READ    A140
SLOPE   000C    TEMPIX  000D    VECTOR  A184    WRTDOT  A1C2
X1      0002    X1LOAD  0008    X2      0004    XDIFF   000A
Y1      0003    Y1LOAD  0009    Y2      0005    YDIFF   000B
```

```
0090 REM RANDOM WALK demonstration using BASIC and graphics driver
0100 LET C=0 : REM location of COLOR byte
0110 LET P=1 : REM location of PIXEL byte
0120 LET X1=2: REM cursor x coordinate
0130 LET Y1=3: REM cursor y coordinate
0140 LET X2=4: REM vector x endpoint
0150 LET Y2=5: REM vector y endpoint
0160 LET I=41216 : REM location of graphics initialization routine
0170 LET E=41255 : REM location of screen erase routine
0180 LET R=41280 : REM location of pixel read routine
0190 LET W=41319 : REM location of pixel write routine
0200 LET V=41348 : REM location of vector generator routine
0300 CALL( I,0)
0305 FOR Y=0 TO 300 :REM scribble/scrabble
0310 POKE( X2,255*RND(0)):POKE(Y2,255*RND(0))
0320 CALL( V,0)
0330 NEXT Y
0340 CALL( E,0)
0350 POKE( C,0)
0360 FOR Y=0 TO 400
0370 POKE( X2,255*RND(0)):POKE(Y2,255*RND(0))
0380 CALL( V,0)
0390 NEXT Y
0400 END
```

Demonstration program in BASIC.

```
P
S11301004FC67FD7419740BD013CBDA1007E02E2AE
S1130110D6439642DB419940D702D6459644DB410B
S11301209940D703D6479646DB419940D704D64930
S113013096 48DB419940D705BDA18439CE004CBD1A
S113014003E33736860BC6A3373630A602E603BD73
S113015003653131313 1C0058200D74B974ACE0057
S11301604CBD03E33736860BC6A3373630A602E60A
S113017003BD036531313131C0058200D74F974E3D
S1130180CE004CBD03E33736860BC6A3373630A604
S113019002E603BD036531313131C0058200D75118
S11301A09750CE004CBD03E33736860BC6A33736D3
S11301B030A602E603BD036531313131C00582004A
S11301C0D7539752CE004CBD03E3C4208400D7001C
S11301D039D6439642DB4B994AD0419240D7439754
S11301E042D6459644DB519950D0419240D7459729
S11301F044D6479646DB4F994ED0419240D7479715
S113020046D6499648DB539952D0419240D74997F4
S113021048D6459644405082 00D7459744D64996DF
S11302204840508200D7499748BD0110D6439642B2
S11302304050 8200D7439742D6479646405082 00AA
S1130240D7479746BD0110D645964440508200D703
S11302504597 44D6499648405082 00D7499748BDAF
S113026001 10D64396424050 8200D7439742D64766
S11302709646405082 00D7479746BD0110CE004CA9
S1130280BD03E337368605C61E373630A602E603BD
S1130290BD036531313131C00582002606 5D260378
S11302A0BD013CCE004CBD03E3C0C882002C037EDC
S11302B002B57E01D1BDA127D6004FC02082002601
S11302C0065D26037E02D6D6004FC00082002606B5
S11302D05D26037E02DD4F5FD7007E02E24FC6201B
S11302E0D700CE004CBD03E337368601C60437364B
S11302F030A602E603BD036531313131CB018900FB
S1130300D7439742CE004CBD03E337368601C6047B
S1130310373630A602E603BD036531313131CB01F6
S11303208900D7479746CE004CBD03E33736860194
S1130330C604373630A602E603BD036531313131D8
S1130340D7459744CE004CBD03E337368601C60437
S1130350373630A602E603BD036531313131D74962
S113036097487E022C3736E601375FA6002A075CE1
S1130370304060008200363734 30E603260D4D26C7
S113038 00ADE122755C621D7146E006D042A0A60AE
S11303900460052 4026A046C0186016D022B0B4C77
S11303A0680369022B04811126F5A700A604E6055B
S11303B06F046F05E003A2022407EB03A9020C20DB
S11303C0010D69056904640266036A0026E6A60451
S11303D0E605660124044050820031313131313167
S11303E0393C0CA60148AB00E60158495849EB01D9
S11003F0A900CB198936A700E7014456394E
$
```

Demonstration program in machine language. MIKBUG-formatted dump of a program which will produce a beautiful high-speed kaleidoscopic display, which will run indefinitely. Perform a jump to location $0100 to start the demonstration. The graphics driver in the article and ORGed at $A100 must also be present.

The DOT subroutine turns a particular pixel either on or off, depending on the status of bit 5 of the byte in the COLOR register. This routine requires about 45 machine cycles or about 35 us per dot on a 1.3 MHz computer. Before this routine is called, the pixel coordinates must be loaded into the X1 and X2 registers.

The vector generator routine is one of the most important subroutines in a graphics driver package. For maximum effectiveness, it must be capable of the highest operating speed. A general-purpose routine must be able to draw a line between any two arbitrary points within the display area. VECTOR is optimized to do this without using time-consuming multiplication or division steps. This routine draws a best-fit straight line between the current cursor position (X1,Y1) and the point addressed by registers X2 and Y2.

For highest-speed operation in a true vector plotting mode, the cursor is automatically updated to the current address stored in (X2,Y2) during execution. This means that in order to draw a series of connected line segments you need only to consecutively feed the last end point of each segment to (X2,Y2) before each call to VECTOR. This routine recognizes a vertical or horizontal line and ignores the slope calculations for highest-speed operation in these special cases.

There is, on the average, a 100 cycle set-up and exit overhead involved with each call to this subroutine. An additional 70 machine cycles per pixel is required by VECTOR to construct a typical sloping line segment. This means that less than 14 ms is required to draw a 256 pixel sloping line segment on a 1.3 MHz CPU. This is more than 100 times faster than the Electric Crayon operating under the EGOS operating system in its 256 × 192 (highest) resolution single color mode.

The short demonstration programs which follow the controller software were written in Computerware's random BASIC Ver. 5.10, to show off the graphics commands. PEEK, POKE and CALL statements were used to communicate with the controller software. Although the J variable in Computerware's CALL (I,J) statement is available for use in the A accumulator when execution of the machine-language program begins, use of this transfer was not made to keep the controller software universal. ■

See List of Advertisers on page 194

This hardware/software combination from Micro Technology Unlimited teams up to deliver a knockout high-resolution graphics display.

A One-Two Punch For CBM/PET Graphics

By J. W. Froelich

The CBM/PET series of computers has been limited in the past by an inadequate graphics display. The 40 × 24 raster of high resolution 80 × 48 point plotting is unacceptable for graphics, data plotting or illustrations. To offset this deficiency, Micro Technology Unlimited (MTU, Box 12106, Raleigh, NC 27605) has developed a high-resolution graphics display which yields a 320 wide by 200 high dot matrix display and a software package which makes full use of the graphics board.

Both the hardware—Integrated Visible Memory Board (IVMB)—and the software—Keyword Graphics Package (KGP)—must be presented together, since they are truly complementary.

Address correspondence to J. W. Froelich, 9 Brown Place, Woburn, MA 01801.

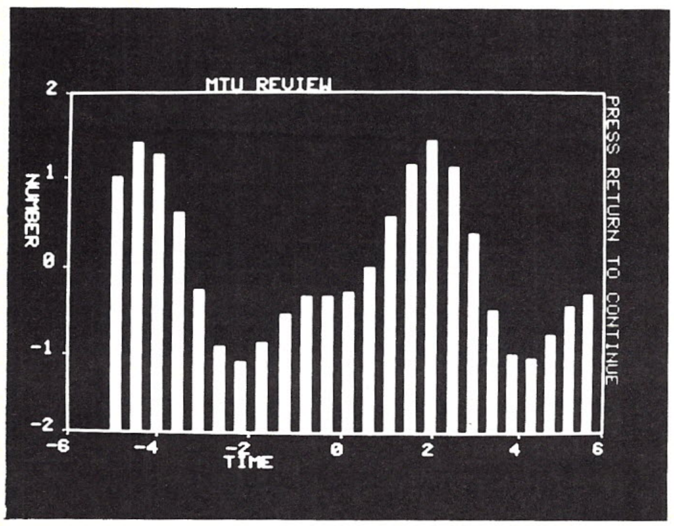
The Integrated Visible Memory Board (IVMB)

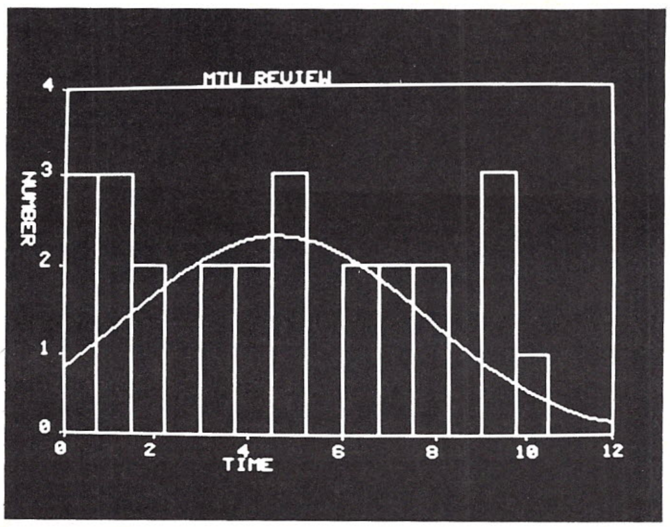
The IVMB board contains 8K of memory divided into two 4K blocks and composes the 320 × 200 dot matrix. The board has jumpers that let you select the address of the two 4K memory blocks. The board comes factory-configured for locations $9000 through $AFFF, space not typically used by the CBM computer. Reconfiguring the board for other locations is simple since the jumpers are staple-shaped wires that plug into DIP sockets, and are thus easily moved.

The 8K of memory is used in a dual-port configuration, similar to the PET's on-board screen memory. The matrix memory looks like ordinary memory to the computer, but there is additional circuitry on the IVMB to generate video output.

IVMB controls the video screen by routing the video output from the main computer board through the IVMB, and a software register controls which video signal (IVMB or CBM) goes to the screen (Fig. 1).

The IVMB contains five ROM sockets that have jumpers to select their memory locations. A software-





Photos 1a and b. Statistical data drawn on the IVMB by the program SLIDE.

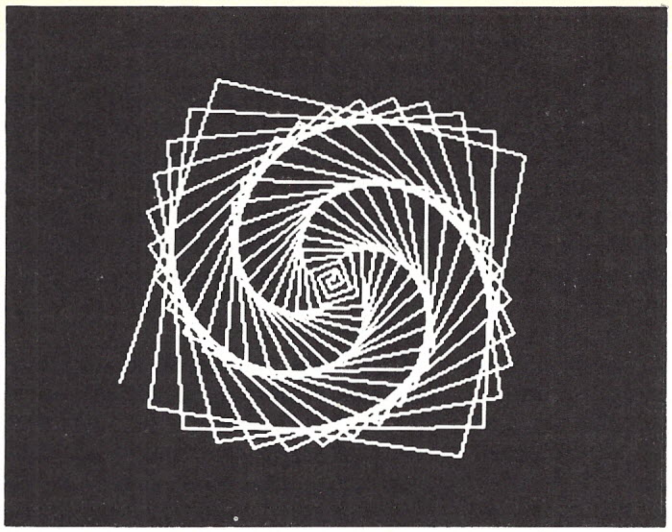


Photo 2. *Example of 3-D graphics.*

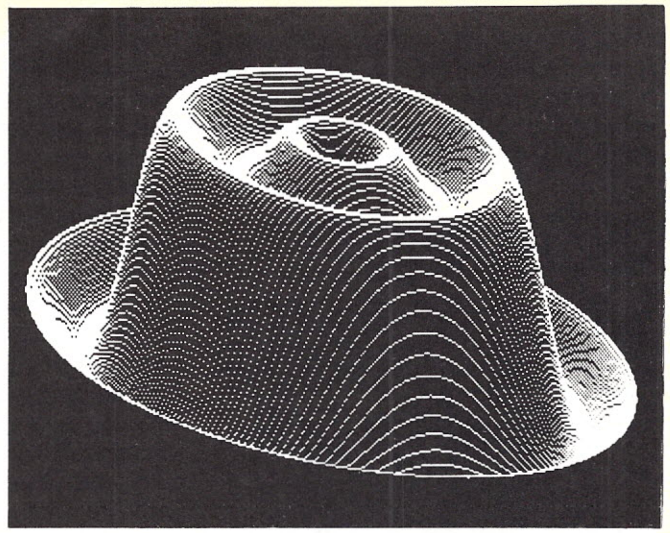


Photo 3. *An Archimedes Spiral.*

controlled register allows selection of any or all the sockets. This lets you use multiple ROMs that reside at the same memory location; for instance, Wordpro and Toolkit ROMs can all reside at the same memory locations and be software-selected.

A light pen register is present on the board. This register works by trapping the raster scan pointer within two eight-bit registers which represent the most- and least-significant bits of its address within the IVMB memory. The board also contains buffers and decoding circuitry that allow expansion through the KIM bus. MTU sells a card cage with five expansion slots for this purpose. Jumpers are also present to modify decoding of addresses on the expansion bus. Boards that can be added include the CODOS disk system and expansion memory.

Programming

Programming of the board can be performed by peeking and poking to the memory and registers, but this is cumbersome. The best way of controlling the IVMB is through the use of the Keyword Graphics Package.

IVMB comes pretested by MTU. The board has been jumpered for the most common CBM configuration, but a table has been provided for other configurations. Reconfiguring seldom requires moving more than four jumpers.

IVMB connects to the computer board through a 60-line cable to the expansion connector. Wires are soldered to the unregulated power terminals on the CBM board. The unregulated power is also routed through the KIM bus for the expansion boards. The video signal from the main circuit board and the signal to the screen are routed through the IVMB. Standard connectors are provided so that the original wires need not be changed.

If expansion beyond the IVMB is not desired, then the board can be mounted under the CBM cover. Installing and testing the board should take less than one hour.

Keyboard Graphics Package

The Keyboard Graphics Package (KGP) is an 8K memory of assembly-language subroutines that are callable from BASIC. The package resides in the upper 8K of user RAM and therefore requires a minimum of 16K RAM within the computer. This would allow 8K programs, so if larger programs are desired a 32K machine is necessary.

The loading of the program requires first altering the size of program memory by poking new values into the memory size register. After this is done the program is loaded into high memory, above the designated user memory. The routines are then linked to the BASIC monitor via an SYS call. The routines modify the monitor so that all lines of commands or program are routed through KGP. Thus, in-text graphic commands are valid.

KGP contains over 45 commands. There are too many to describe here, so an overview of the most important commands follows.

The software contains sophisticated character commands that can write single characters or strings of characters on the screen. Two modes of character display are provided: one truncates characters if they extend off the screen, and the other will automatically wrap around and scroll. Character size, as well as rotation of the character in 90-degree increments, can be determined by a single command. The scrolling commands are very powerful and allow moving all or portions of the screen at will, thus letting you write a bidirectional editor or a moving window, as in animation.

KGP allows the screen to be divided into a maximum of four viewing windows, which are useful for split-screen functions. Each window can be handled like a different screen. When using characters within a window, the scrolling and wrap-around

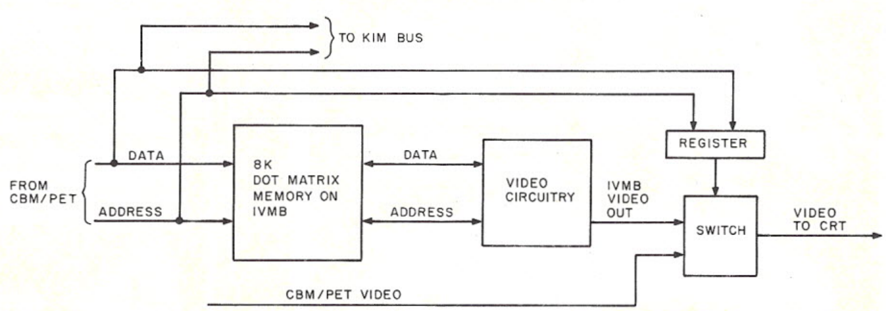


Fig. 1. Schematic drawing of the functional aspects of the Integrated Visible Memory Board.

routines function within the subscreens. Commands are available to move the cursor, draw or erase individual points, draw or erase lines and draw dotted lines. Coordinate transformation is also available to simplify programming.

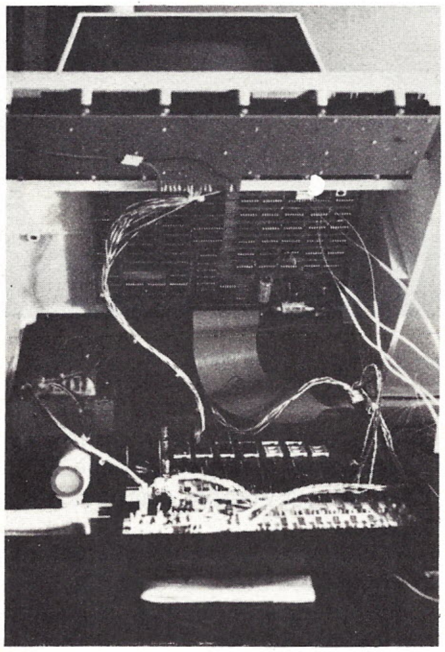


Photo 4. Integrated Visible Memory Board.

An innovative function is that of user-defined characters and figures. You can store up to 255 predefined shapes, each of which can be recalled by a given ID number and drawn anywhere on the screen. Characters are drawn at machine-language speed, thus allowing animation.

KGP has many more functions that enhance and expedite the basic task of symbol-drawing and presentation. The documentation for the software is good (not excellent) for the basic functions but more difficult to understand for the advanced functions. The documentation would be improved by adding more examples of programming tasks and/or problems.

Programming

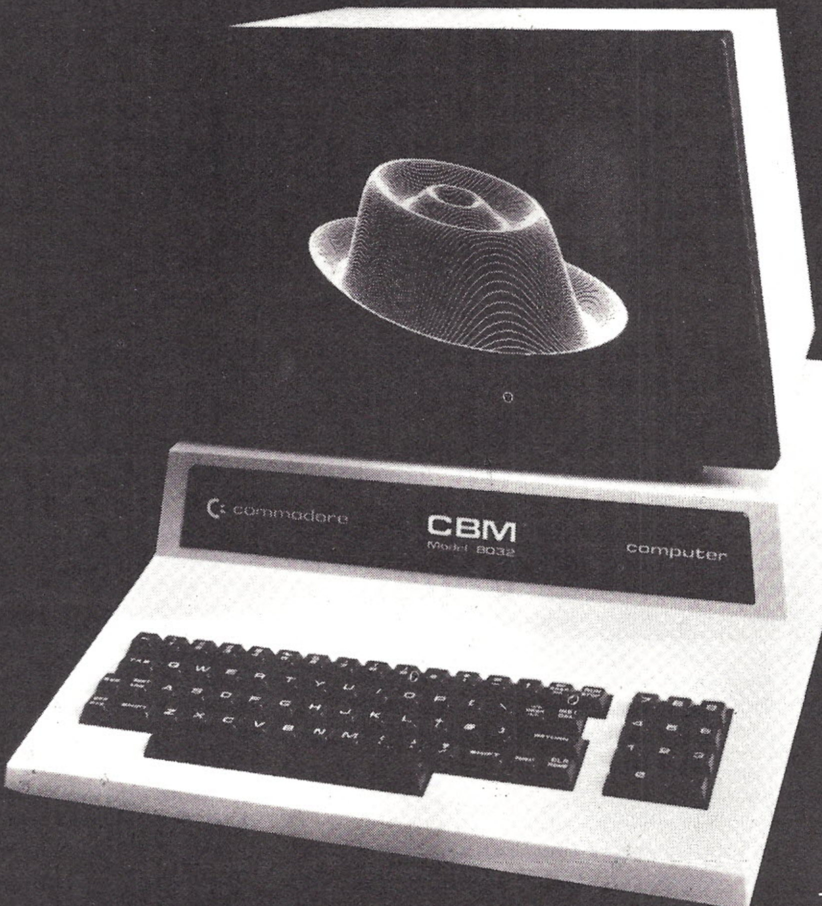
The value of a good software package can only be determined through its use. All the photos within this article have been programmed and drawn on my PET/CBM. Photos 1a and b are from a converted program called SLIDE, which appeared in *Byte*. The conversion of SLIDE from the Compucolor computer to KGP was straightforward, and eased by the KGP commands, which seem more usable than those available on the Compucolor computer. Except for color selection, there appears to be a one-for-one command correspondence between KGP, Compucolor and Apple graphics packages.

Conclusion

KGP implemented on the Integrated Visible Memory Board is a good dot-matrix display for the CBM/PET series of computers, and other KIM-bus computers. The screen, when photographed with high-contrast films as used in this article, yields publication-quality images. I use the KGP primarily for the graphic display of statistics, and I've been pleased with the results.

The hardware and software combination can be bought complete and ready to install for $495. This may seem a bit much for the average hobbyist, but for specific applications this is quite reasonable. The combination is a good value for the scientific and technical user.■

80 COLUMN GRAPHICS



The Integrated Visible Memory for the PET has now been redesigned for the new 12" screen 80 column and forthcoming 40 column PET computers from Commodore. Like earlier MTU units, the new K-1008-43 package mounts inside the PET case for total protection. To make the power and flexibility of the 320 by 200 bit mapped pixel graphics display easily accessible, we have designed the Keyword Graphic Program. This adds 45 graphics commands to Commodore BASIC. If you have been waiting for easy to use, high resolution graphics for your PET, isn't it time you called MTU?

The image on the screen was created by the program below.

```
 10 VISMEM: CLEAR
 20 P=160: Q=100
 30 XP=144: XR=1.5*3.1415927
 40 YP=56: YR=1: ZP=64
 50 XF=XR/XP: YF=YP/YR: ZF=XR/ZP
 60 FOR ZI=-Q TO Q-1
 70 IF ZI<-ZP OR ZI>ZP GOTO 150
 80 ZT=ZI*XP/ZP: ZZ=ZI
 90 XL=INT(.5+SQR(XP*XP-ZT*ZT))
100 FOR XI=-XL TO XL
110 XT=SQR(XI*XI+ZT*ZT)*XF: XX=XI
120 YY=(SIN(XT)+.4*SIN(3*XT))*YF
130 GOSUB 170
140 NEXT XI
150 NEXT ZI
160 STOP
170 X1=XX+ZZ+P
180 Y1=YY-ZZ+Q
190 GMODE 1: MOVE X1,Y1: WRPIX
200 IF Y1=0 GOTO 220
210 GMODE 2: LINE X1,Y1-1,X1,0
220 RETURN
```

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NOW 80 COLUMN PETS CAN HAVE MTU HIGH RESOLUTION GRAPHICS

Display text on your screen while using Apple's HIRES page-2 graphics.

Mix It Up On Your Apple

By R. Daniel Bishop

One of the Apple computer's attractive features is its high-resolution color graphics. The full-screen page-1 high-resolution graphics mode lets you display two colors besides black and white.

Alphanumeric text information can be included into the display with the POKE-16301,0 command. This command removes the bottom one-sixth of the graphics display and reveals in its place the bottom four lines of text material located in the buffer in text page-1. This type of display is referred to as the mixed graphics-plus-text mode, or simply the mixed mode. Using the mixed mode, you can include labels, instructions or descriptive text material with your graphics display.

In addition to the page-1 high-resolution graphics, systems with at least 24K of RAM memory can access a page-2 of high-resolution graphics. This page is displayed by using the HGR2 command, and its buffer area occupies RAM memory between 16K and 24K. This gives you a second high-resolution graphics display that can be stored and used independently of the first display, or that can be used in conjunction with the first page for special effects, such as animation.

The page-2 display is also used extensively with longer programs that require use of the 8K to 16K RAM area for the BASIC program itself. This is due to the fact that the 8K to 16K RAM area is the same memory used by page-1 of the high-resolution graphics; thus, long programs render page-1 unavailable.

The only drawback to using page-2 HIRES graphics, however, is that you no longer have simple use of the mixed-mode display. In the words of the *Applesoft Manual* (p. 88), in using the POKE-16301,0 command after the HGR2 command, ". . . the four lines of text are taken from page-2 of text, which is not easily accessible to the user."

But with a little effort, you can use the mixed mode for page-2 quite effectively. It then becomes possible to incorporate the mixed mode with page-2 HIRES graphics into your program with only a few short subroutines and some careful planning. The simple program provided here illustrates how.

The Mixed Mode

To understand the relationship between the HIRES graphics pages and the text pages, you must study the memory map shown in Table 1. Memory begins with page 0 and can be extended to page 255 in a 64K system. Each page in memory accounts for 256 bytes of memory storage. A single page of HIRES graphics memory requires 8192 bytes, or 32 pages of memory. Note that page-1 of HIRES graphics uses pages 32 through 63 of RAM, space that is easily required by a moderately long BASIC program, while page-2 of HIRES graphics occupies pages 64 to 95 of RAM.

Each page of text requires only 1024 bytes, or four pages, of memory. Text page-1 is located on pages 4–7 of memory, and text page-2 occupies pages 8 through 11. Here is where the root of the problem lies. The BASIC program code is stored in RAM beginning on page 8 of memory. An attempt to use a HIRES page-2 display in mixed mode, thus displaying four lines of text from text page-2, will result in the display of four lines of BASIC program code in the text window at the bottom of the screen.

When you are using HIRES page-1 in mixed mode, the procedure for printing text onto the screen in the text window is very simple. While in the HGR mode, a HOME command clears text page-1 with no visible effect on the video monitor. Then a POKE -16301,0 command will reveal the blank text window at the bottom of the display. The cursor is positioned in the text window with a VTAB=20, and a normal PRINT statement is used to display the line of text or desired variables in the window. The POKE command can come before the VTAB or after the PRINT statement, depending on the visual effect desired. To return to full screen graphics, use POKE -16302,0. To return to all text, a POKE -16303,0 or the TEXT command is used.

In the above process, the PRINT command can be thought of as poking the alphanumeric characters into the appropriate locations of text page-1. The same process must be used to get information to appear in the text window when using HIRES page-2 in mixed mode. However, the process is "not easily accessible to the user" because poking random information into memory occupied by the BASIC program will normally destroy the program. To avoid this disaster and at the same time make use of page-2 mixed mode, the following procedures must be followed:

1. The four areas of RAM used by the four lines of page-2 text must be protected by reserving this space

Address correspondence to R. Daniel Bishop, Custom Comp, Box 429, Buena Vista, CO 81211.

RAM pages	Use	Hex Location	Decimal Location
0–3	System buffers.	0000–03FF	0–1023
4–7	Text page-1; Video display buffer.	0400–07FF	1024–2047
8–11	Text page-2; User BASIC program storage begins here also.	0800–0BFF	2048–3071
12–31	User BASIC program storage.	0C00–1FFF	3072–8191
32–63	HIRES graphics page-1; User BASIC program storage.	2000–3FFF	8192–16383
64–95	HIRES graphics page-2; User BASIC program storage.	4000–5FFF	16384–24575
96–191	User BASIC program storage.	6000–BFFF	24576–49151
192–255	I/O and ROM.	C000–FFFF	49152–65535

Table 1. Apple memory map. Information for this table was obtained from the 1979 edition of the Apple Reference Manual, *p. 69. Notice that the user BASIC program storage area overlaps the RAM dedicated to text page-2.*

within the BASIC program itself.

2. Information to be printed into these text lines will be converted into string variables.

3. Each character in the string to be transferred into the text lines will be individually poked into its appropriate position.

To carry out step three, the appropriate Apple machine code must be assigned to each character. This gives you an easy way to use inverse or flashing characters along with your text for some dazzling displays.

This Space Reserved

The four lines of text which appear in the text window of a page-2 mixed-mode display are, unfortunately, *not* stored in contiguous areas of RAM. Each line is, of course, 40 bytes long, and their respective locations are presented in Table 2. The BASIC program must be restructured so that these areas appear within the quotation marks of a PRINT statement. In that way, the size of the reserved space can be predetermined and will not be altered during the execution of the program.

This ensures that each of the four reserved locations will always fall precisely where they are needed in RAM. These four PRINT statements, however, need never be executed. (REM statements may also be used, as long as they are followed by enough characters to ensure that the reserved area is covered.)

Now that the RAM locations for the reserved spaces are known (Table 2), the program must be carefully tailored to fit them in. This is done by entering the first 1200 bytes of BASIC code for the program and being sure that these parts of the program function perfectly. Once the reserved areas have been incorporated into the program, any change or modification to this part of the program might alter the byte count preceding the reserved areas and cause them to become relocated. It would then be necessary to go back and readjust each of these so that they again fall into the desired areas of RAM.

The BASIC program must now be examined in machine code using the monitor, accessed by CALL -151. What you must find is the BASIC program line number for the program line that runs through hex-0A4A in memory. You must place the PRINT statement directly before this program line and provide enough blanks between the quotes to push this program line past hex-0A78. This is done as follows:

1. Enter 0A00 and carefully scroll through the resulting memory dump by repeatedly pressing the return key. Remember that each program line is preceded by a hex-00 byte, that the first two bytes in a program line are the next-line pointer which gives the address where the next line will be found, and that the next pair of bytes displays the actual BASIC program line number (in hex, of course, with the low order byte before the high order byte). Also remember that it takes two characters to define a byte.

2. Look for a zero (00) as you scan through the machine code from 0A00, which signifies the end of one program line and the beginning of another. When you find a zero, look at the next two bytes which give the location of the next program line (reverse order). If those bytes are less than 0A4A, then proceed on to the next zero. As soon as you find a next-line pointer that points *beyond* 0A4A, you have found the BASIC program line that must be pushed back to make room for line one of reserved RAM. Analyze the second pair of bytes and convert them to a decimal number (remember to reserve their order). This will correspond to a BASIC program line number in your program.

3. Determine how many bytes you will have to reserve to get from this point in RAM to the end of the first line's reserved space, 0A78. Be sure to do your counting in hex! This value will correspond to the number of blank spaces to reserve between the quotation marks in the PRINT statement.

4. Return to BASIC command mode by pressing the break key, and insert your PRINT line along with the appropriate spaces immediately ahead of the program line identified in step 2.

5. Return to the monitor mode and scan from 0A50 to 0A78 to verify that all 40 bytes are filled with 20s, which is the hex equivalent of 32, which is the ASCII code for the space character.

6. Exactly the same procedure is followed for the remaining three reserved spaces. For the second line, you are looking for a next-line pointer that exceeds 0ACA; for the third, 0B4A; for the fourth, 0BCA. Use Table 2 to arrive at your byte count and

Mixed-mode Text Line	Hex Location	Decimal Location
Line one	0A50–0A77	2640–2679
Line two	0AD0–0AF7	2768–2807
Line three	0B50–0B77	2896–2935
Line four	0BD0–0BF7	3024–3063

Table 2. Areas in text page-2 that will be displayed when high-resolution graphics page-2 is used in mixed mode. The decimal location ranges for each of the four lines give the permissible values for the variable FY, which is used by the POKE subroutine.

```
94 J=LEN(AZ$)
96 IF FY<2680 THEN JJ=2680-FY: GOTO 101
97 IF FY<2808 THEN JJ=2808-FY: GOTO 101
99 IF FY<2936 THEN JJ=2936-FY: GOTO 101
100 JJ=3064-FY
101 IF J>JJ THEN J=JJ
105 FOR I=1 TO J
107       FX=0
108       Z$=MID$(AZ$,I,1)
110       IF ASC(Z$)<64 THEN FX=64
112        POKE FY, ASC(Z$)+FZ+FX
115       FY=FY+1
120 NEXTI
125 RETURN
```

Listing 1. The POKE subroutine which pokes the characters contained in AZ$ into the page-2 text window. Lines 96–100 check the length of AZ$ to be sure that there is enough room left on the line for the entire string to be poked. If the string is too long, it is truncated (line 100).

to verify that the appropriate spaces have been set aside.

In your BASIC program, you now have four new lines. Each is a PRINT statement that reserves one line in text page-2 to be used with HIRES page-2 in mixed mode. There is still one remaining nuisance to be worked out. Whenever you run the program, machine code will be poked into the reserved memory locations. If you then end the program and list it, all sorts of mysterious coding will appear in the PRINT statements. To keep everything tidy, the following line should be incorporated just before the END statement.

FORI=0TO39:POKE2640+I,32:POKE2768+I,32:POKE2896+I,32:POKE3024+I,32:NEXTI

This will restore the listing to its original pristine condition.

An example may be helpful. Suppose that you are in the monitor mode looking for 00 in the memory dump. You may find a zero byte at location 0A1F. The next two bytes are 3A 0A, which, when reversed, become 0A3A. This is not larger than 0A4A so you proceed with the dump. The next 00 comes up at 0A39 (of course)! The following two bytes are 4D 0A. This is larger (as 0A4D) than 0A4A, so this is the line you are after.

The next two bytes are C2 01. Reversing the order, we have 01C2, and converting this to decimal gives us 450, which is our BASIC program line number. Now if you put a PRINT statement at 0A3A, you will need 0A78–0A3A, or 3E bytes of blanks; that is, you will need to insert 62 blanks between the quotation marks (actually, four less, but it helps to leave a little room for error). After returning to BASIC command mode, you type in line 449 PRINT"...62 blanks..." and you have your first reserved space inserted into the program.

The POKE Subroutine

Now that the necessary memory spaces have been reserved for the text page-2 window display, all that remains is to poke the information to be displayed into that window. The simple subroutine presented in Listing 1 does this very nicely. Furthermore, it lets you choose whether a particular portion of the display will be in normal, inverse or flashing mode simply by proper choice of values for the variable FZ. Table 3 lists the values that FZ may take to achieve different display modes.

Before calling the subroutine, you must specify where in the text window you want the information to appear and assign this number to FY. FY must fall within the four decimal ranges given in Table 2. The next step is to convert the character information into a string, AZ$. Numeric information must first be converted to string variables using the STR$ function before being assigned to AZ$. To achieve the desired effect, you may wish to separate all numeric and special characters from the alphabetic characters and access the subroutine several times consecutively with different values of FZ.

Finally, you determine which display mode you wish to use for the characters in AZ$ and, using Table 3, assign the appropriate value to FZ. (Of course, if FZ has been previously defined with the desired value, it is not necessary to redefine it. Similarly, FY increments during the subroutine, and if new information is to be placed on the same line and directly following the last entry, FY will already have the desired value and needn't be redefined.)

Lines 96 through 101 in the subroutine (Listing 1) are optional. If you can be sure that the data you are poking will not exceed the length of the line

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Value For FZ	Resulting Display Mode
128	NORMAL
0	FLASHING
−64	INVERSE

Table 3. Values that must be assigned to FZ in order to achieve a desired display mode for a given character type. The ASCII value for the specific character is incremented (or decremented) by the value of FZ to arrive at the machine code which corresponds to the desired display mode.

remaining for it, then these lines can be omitted.

A very important word of caution is in order here. Whenever you are writing a program that modifies its own code by poking data into the program, always save a copy of the latest version on tape or diskette *before* testing or running the program. Failure to do this could result in total loss of your program if a slight oversight or error has been made in the POKE locations.

Flower Garden—A Demonstration Program

The short program in Listing 2 demonstrates the approach outlined above for obtaining mixed-mode graphics-plus-text display while using page-2 of high-resolution graphics. It illustrates not only the display of static data, but also of variables and of interactive keyboard response information.

Compare lines 94 through 125 of the two listings. It just happened that the required reserved space in this program fell in the memory used for the POKE subroutine itself. So you see lines 95, 98, 104 and 109 embedded within the subroutine. This may occasionally present a problem, although the only unexpected result in this program is a random control-G (bell) when these PRINT statements are actually executed. An alternative might be to add a couple more PRINT statements between those shown and essentially cordon off the whole block of RAM from hex-0A4A through 0BF8, using a GOTO statement to jump around the PRINT commands. The principle is, of course, the same.

When typing the code for this program into the computer, be absolutely sure that the code is duplicated exactly, at least through line 109. This includes the remarks and all blank spaces. For convenience, each large blank PRINT statement is accompanied by a remark specifying the number of blanks contained between the quotation marks.

Line 16 in Listing 2 is a blank PRINT buffer, which comes in handy in relocating the positions of the reserved areas if you must alter any of the code between lines 1 and 94. Adding extra blanks will push the reserved areas back into higher RAM; deleting blanks will pull them forward.

The main program lies between lines 1000 and 1265. After a brief introduction, a garden plot is drawn (subroutine 70) and you are asked to give a location (L) (a number between 0 and 24000) for your flower and

whether the flower is to be small or large (SC and SC$). The plant's location in X,Y coordinates is then calculated from L in subroutine 50 and the flower is drawn into the garden plot from a simple shape table which was poked into RAM at the start of the program (subroutine 35). The graphics routine is found beginning at line 23.

Interactive keyboard response is handled by the subroutine between lines 199 and 265. N$ accumulates the successive keyboard entries. Another important variable here is FM. To prevent you from entering too much data, thus overflowing the reserved space and potentially crashing the program, FM is assigned the maximum value FY may have for the specific line being used (see Table 2). When FY has been incremented to this value, further input is impossible.

Another use for FM is for single key entry for responses such as "Y/N". If FM is less than FY when the subroutine is called, only one key-in is allowed before a return is made to the main program. This is demonstrated with the "flower size?" and the "continue?" routines.

As mentioned earlier, before ending the program it is wise to tidy up the reserved space. This is done in this program with the subroutine beginning at line 300. Note that a variable FZ is used. At the program's conclusion, FZ is given a value of 32 to restore the blank spaces in the PRINT statements. However, any other valid number can be used as well, allowing this routine to be used to fill the text window with any desired character in any desired mode. Refer to page 15 of the *Apple Reference Manual* for the appropriate codes. An example is provided in this program by responding with a location that is larger than 24000.

Finally, I should repeat a warning that I stated earlier. Before testing the program out, do a CALL-151 and verify that the reserved regions are indeed filled with blanks (hex-20) and are in the required areas of RAM. Then save this copy of the program before typing RUN. At least then, should there be any problems, you won't have to begin coding from the beginning.■

Listing 2. Flower Garden program, which demonstrates the techniques of introducing text into the text window at the bottom of the screen in page-2 high-resolution graphics. The first 109 lines must be reproduced exactly, *including remarks and blank spaces in order for the program to work properly.*

```
1 REM  FLOWER GARDEN
2 REM  DEMONSTRATION
3 REM  OF HIRES-PAGE2
4 REM  GRAPHICS IN
5 REM  MIXED MODE
10 LOMEM:24600
14 REM BZ$ HAS TWENTY BLANK SPACES
15 BZ$="                    "
16 PRINT"                               ":REM 31 BLANKS
20 GOTO 1000


23 ROT=0
24 SCALE=SC
25 FOR I=1 TO 4
27 DRAW 1 AT X,Y
28 ROT=15*I
29 NEXTI
30 RETURN


35 POKE 232, 04
36 POKE 233, 96
40 DATA 1,0,4,0,46,46,46
41 DATA 44,44,36,39
42 DATA 39,55,55,55,00
45 FOR I=1 TO 16
46 READ A
47 POKE 24579+I, A
48 NEXT I
49 RETURN


50 Y=INT(L/200)
55 X=L-(200*Y)+39
60 Y=Y+20
65 RETURN


70 HCOLOR=1
75 HPLOT 37,19 TO 239,19 TO 239,140 TO 37,140 TO 37,19
80 RETURN


90 FOR I=1 TO 5000:NEXTI:RETURN
94 J=LEN(AZ$)
95 PRINT"
    ": REM 60 BLANK SPACES
96 IF FY<2680 THEN JJ=2680-FY: GOTO 101
```

More

Listing 2 continued.

```
97 IF FY<2808 THEN JJ=2808-FY: GOTO 101
98 PRINT"                                                  ": R
EM 50 BLANKS
99 IF FY<2936 THEN JJ=2936-FY: GOTO 101
100 JJ=3064-FY
101 IF J>JJ THEN J=JJ
104 PRINT"                                                  ": R
EM 50 BLANKS
105 FOR I=1 TO J
107 FX=0
108 Z$=MID$(AZ$,I,1)
109 PRINT"
                    ": REM 70 BLANKS
110      IF ASC(Z$)<64 THEN FX=64
112       POKE FY, ASC(Z$)+FZ+FX
115      FY=FY+1
120 NEXTI
125 RETURN


199 N$=""
200 GET AZ$
205 IF ASC(AZ$)=13 THEN RETURN
210 IF ASC(AZ$)=8 THEN GOTO 250
215 GOSUB94
220 N$=N$+AZ$
225 IF FY<FM THEN GOTO 200
230 RETURN
250 AZ$=" ":FY=FY-1
251 N$=LEFT$(N$,LEN(N$)-1)
255 GOSUB94
260 FY=FY-1
265 GOTO200


300 FOR I=0 TO 39
305      POKE 2640+I, FZ
310      POKE 2768+I, FZ
315     POKE 2896+I, FZ
320     POKE 3024+I, FZ
325 NEXTI
330 RETURN

1000 GOSUB 35
1005 HGR2
1010 GOSUB 70
1015 HCOLOR=2
1020 POKE -16301,0
1025 AZ$="WHAT IS YOUR NAME"
1030 FY=2650:FZ=128
1035 GOSUB 94
1040 AZ$="?":FZ=0:GOSUB 94
1045 FY=2780:FM=2807
1050 FZ=-64:GOSUB 199
1055 AZ$="I AM GLAD TO MEET YOU "+N$
1060 FY=3024:FZ=0
1065 GOSUB 94:GOSUB 90
1070 AZ$=BZ$+BZ$
1075 FY=2640:FZ=0
1080 GOSUB 94
1085 FY=3024:GOSUB 94:GOSUB 90
1090 FY=2768:FZ=128:GOSUB 94


1095 N=0
1100 AZ$="THE GARDEN HAS 24000 LOCATIONS."
1105 FY=2640:FZ=-64:GOSUB 94
1110 N=N+1
1115 AZ$="WHERE DO YOU WANT FLOWER #"+STR$(N)+"?"
1120 FY=2768:FZ=128:GOSUB 94
1125 FY=2896:FZ=0:FM=2935
1130 GOSUB 199
1135 L=VAL(N$)
1140 IF L<0 OR L>24000 THEN FZ=128:GOSUB300:GOTO1100


1145 AZ$="WHAT SIZE FLOWER?"
1150 FY=3024:FZ=128:GOSUB 94
1155 FY=3042:FZ=0
1160 AZ$="S.....L"
1165 GOSUB 94
1170 AZ$="MALL/"
1175 FY=3043:FZ=128:GOSUB 94
1180 AZ$="ARGE?"
1185 FY=3049:GOSUB 94
1190 FZ=0: GOSUB 199
1195 SC$=LEFT$(AZ$,1):SC=2
1200 IF SC$="S" THEN SC=1:GOTO 1210
1205 IF SC$<>"L" THEN GOTO 1145
1210 GOSUB 50: GOSUB 23
1215 FZ=160: GOSUB 300


1220 AZ$="DO YOU WANT TO PLANT ANOTHER?"
1225 FY=2640:FZ=128:GOSUB94
1230 AZ$="Y/N"
1235 FY=2780:FZ=0: GOSUB 94
1240 FZ=-64:FM=2679:GOSUB 199
1245 R$=LEFT$(N$,1)
1250 IF R$="Y" THEN GOTO 1100
1255 IF R$<>"N" THEN GOTO 1220
1260 FZ=32:GOSUB 300
1265 HOME:TEXT:END
```

Benefit from this author's experience using graphics routines in a BASIC program.

New, Improved Sorcerer Graphics

By Avram R. Vener

Dr. Colin S. L. Keay provided some excellent graphics subroutines in the March 1980 issue ("Improved Sorcerer Graphics Resolution," p. 74) that can be used to develop medium-resolution graphics within a BASIC program.

Address correspondence to Avram R. Vener, 7 Old Hyde Road, Weston, CT 06883.

Listing 1. The Sketch program.

```
100 REM*************************************************************
110 REM
120 REM MEDIUM RESOLUTION SKETCH PROGRAM
130 REM
140 REM    BY    AVRAM R. VENER
150 REM
160 REM***********************************************************10
7
170 PRINTCHR$(12):PRINT"THIS IS AN ETCH A SKETCH SIMULATOR"
180 INPUT"NEED INSTRUCTIONS";YN$
190 IFYN$="N"THEN320
200 PRINTCHR$(12)
210 PRINT"THE CURSOR WILL MOVE ABOUT THE SCREEN IN THE DIRECTION
"
220 PRINT
230 PRINT"INDICATED BY THE ARROWS ON THE KEYPAD. DIAGONAL "
240 PRINT
250 PRINT"MOVEMENT IS CAUSED BY THE 1,3,7,AND 9 KEYS LOCATED"
260 PRINT
270 PRINT"BETWEEN THE ARROWED KEYS. THE 5 KEY STOPS THE CURSOR"
280 PRINT
290 PRINT"WHILE PRESSIND C CLEARS THE SCREEN AND E LEAVES THE"
300 PRINT
310 PRINT"PROGRAM. ":FORWT=1TO5000:DM=WT:NEXTWT
320 DATA 205,24,224,50,15,0,201:REM GET ROUTINE
330 FORXC=8TO14:READXD:POKEXC,XD:NEXTXC
340 GOSUB930:PRINTCHR$(12)
350 DATA 62,0,246,0,50,1,0,201:REM OR ROUTINE
360 FORXA=0TO7:READXB:POKEXA,XB:NEXT
370 POKE260,8:POKE261,0
380 GET=USR(0):GOSUB710:GOSUB400
390 GOTO370
400 V=X/3:X1=X+1
410 VP=INT(V+1)*64:HP=Y/2:HE=INT(HP):HE=HP-HE
420 IFHE<>0THENMX=2:GOTO440
430 MX=1
440 FORJJ=0TO89STEP9
450 ON(X1-JJ)GOTO470,480,490,470,480,490,470,480,490
460 GOTO500
470 MY=16:JJ=89:GOTO500
480 MY=4:JJ=89:GOTO500
490 MY=1:JJ=89
500 NEXTJJ
510 PN=MY*MX
520 REM SREEN UPDATE
530 PRINTCHR$(17);"X ";X;"  Y";Y
540 LO=INT(-2048-VP+HP)
550 GOSUB650
560 GOSUB580
570 RETURN
580 REM SCREEN UPDATE
590 POKE260,0:POKE261,0
600 R=PEEK(LO)-192
```

More

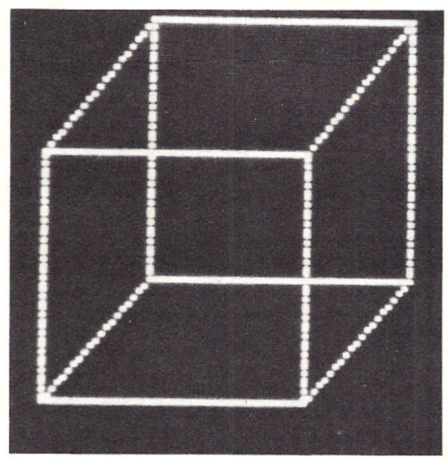


Photo 1. Sample Sketch program output.

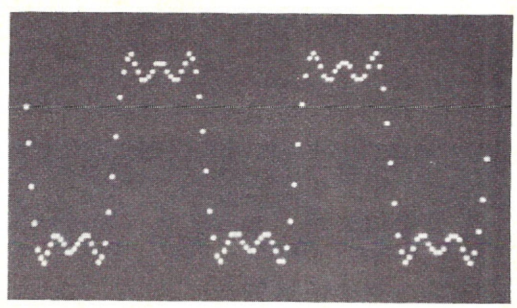
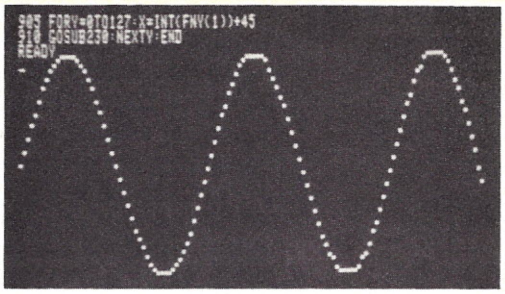
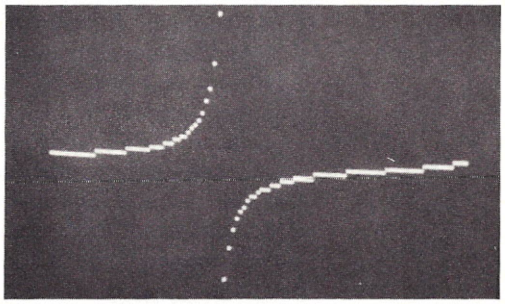


Photo 2. Sample plot of the Function Plotting program.





Photos 3 and 4. Alternative plots.

```
900 FORR=0TO1:POKEP,Q:P=P+1:NEXTR:RETURN
910 POKEP,0:P=P+1:RETURN
920 REM FUNCTION SUBROUTINE
930 DEF FNY(U)=SIN(Y/8*U)*10/U
940 DEF FNZ(U)=COS(Y/8*U)*10/U
950 FORY=0TO127:X=INT(FNY(.5))+45
960 GOSUB290:NEXTY
970 FORY=0TO127:X=INT(FNZ(.5))+45
980 GOSUB290:NEXTY
982 DEF FNX(U)=FNY(U)*FNZ(U)
984 FORY=0TO127:X=INT(FNX(.5))/10+45
986 GOSUB290:NEXTY
988 DEF FNW(U)=FNY(U)+FNZ(U)
990 FORY=0TO127:X=INT(FNW(.5))+45
992 GOSUB290:NEXTY
```

Listing 3. Multiple Function Plot subroutine.

Listing 1 continued.

```
610 IF(R<0ORR>63)THENR=0
620 POKE1,PN:POKE3,R
630 ZZ=USR(0)
640 PN=PEEK(1)+192:POKELO,PN:RETURN
650 REM SAFETY ROUTINE
660 IFLO>-3968THEN680
670 LO=LO+1920:GOTO660
680 IFLO<-2049THEN700
690 LO=LO-1920
700 RETURN
710 REM GET EVALUATION
720 KI=PEEK(15)
730 IFKI=0THEN750
740 KN=KI
750 IF(KN<49ORKN>57)THEN900
760 ONKN-48GOTO770,780,790,800,810,820,830,840,850
770 X=X-1:Y=Y-1:GOTO860
780 X=X-1:GOTO860
790 X=X-1:Y=Y+1:GOTO860
800 Y=Y-1:GOTO860
810 GOTO860
820 Y=Y+1:GOTO860
830 X=X+1:Y=Y-1:GOTO860
840 X=X+1:GOTO860
850 X=X+1:Y=Y+1
860 IFX>89THENX=89
870 IFX<0THENX=0
880 IFY>127THENY=127
890 IFY<0THENY=0
900 IFKN=67THENPRINTCHR$(12)
910 IFKN=69THENEND
920 RETURN
930 REM 3X3 POINT PLOT
940 P=-512
950 FORN=0TO1:FORM=0TO1:FORL=0TO1
960 FORK=0TO1:FORJ=0TO1:FORI=0TO1
970 Q=224*I+14*J:GOSUB1010:GOSUB1020
980 Q=224*K+14*L:GOSUB1010:GOSUB1020
990 Q=224*M+14*N:GOSUB1010
1000 NEXTI:NEXTJ:NEXTK:NEXTL:NEXTM:NEXTN:RETURN
1010 FORR=0TO.:POKEP,Q:P=P+1:NEXTR:RETURN
1020 POKEP,0:P=P+1:RETURN
1030 IFKI=0THEN760
```

Unfortunately for less-experienced programmers, he did not demonstrate the use of these subroutines with an actual BASIC program. It took me a while to get familiar with them, but the time was well-spent. The two BASIC programs that follow show how I used a few of these medium-resolution graphics routines.

Sketch

The Sketch program (Listing 1) lets you create line drawings on the screen (see Photo 1). By using the keypad you can alter the direction of the cursor.

Lines 320 and 330 insert the machine-language GET routine into memory. The subroutine at 930 sets up the 3*2 point plot characters in the user graphics memory. Next, the machine-language OR routine is set up in RAM with lines 350 and 360.

Listing 2. The Function Plotting program.

```
100 REM ********************************************************
101 REM
102 REM MEDIUM RESOLUTION FUNCTION PLOTTING PROGRAM
103 REM
104 REM       BY   AVRAM R. VENER
105 REM
106 REM *********************************************************
107 REM
109 PRINTCHR$(12):PRINT"GRAPH PLOT BY RUDY VENER 9/25/80"
110 INPUT"NEED INSTRUCTIONS";YN$
120 IFYN$="N"THEN139
130 PRINT"This is a Medium resolution plotting program. To plot"
135 PRINT"your function you must modify or completely rewrite"
136 PRINT"the subroutine at location 900. To see what is "
137 PRINT"in the subroutine type S. Otherwise hit RETURN.  "
138 PRINT"To reenter the program after modifying 900, type RUN"
139 INPUTWW$
145 IFWW$="S"THENLIST900
170 GOSUB740:PRINTCHR$(12)
180 DATA 62,0,246,0,50,1,0,201:REM OR ROUTINE
190 FORXA=0TO7:READXB:POKEXA,XB:NEXT
200 POKE260,8:POKE261,0
205 GOTO900
```

More

Listing 2 continued.

```
230 V=X/3:X1=X+1
240 VP=INT(V+1)*64:HP=Y/2:HE=INT(HP):HE=HP-HE
250 IFHE<>0THENMX=2:GOTO270
260 MX=1
270 FORJJ=0TO89STEP9
280 ON(X1-JJ)GOTO300,310,320,300,310,320,300,310,320
290 GOTO330
300 MY=16:JJ=89:GOTO330
310 MY=4:JJ=89:GOTO330
320 MY=1:JJ=89
330 NEXTJJ
340 PN=MY*MX
350 REM SREEN UPDATE
355 PRINTCHR$(17);"X ";X;"  Y";Y
360 LO=INT(-2048-VP+HP)
370 GOSUB470
380 GOSUB400
390 RETURN
400 REM SCREEN UPDATE
410 POKE260,0:POKE261,0
420 R=PEEK(LO)-192
430 IF(R<0ORR>63)THENR=0
440 POKE1,PN:POKE3,R
450 ZZ=USR(0)
460 PN=PEEK(1)+192:POKELO,PN:RETURN
470 REM SAFETY ROUTINE
480 IFLO>-3968THEN500
490 LO=LO+1920:GOTO480
500 IFLO<-2049THEN520
510 LO=LO-1920
520 RETURN
740 REM 3X3 POINT PLOT
750 P=-512
760 FORN=0TO1:FORM=0TO1:FORL=0TO1
770 FORK=0TO1:FORJ=0TO1:FORI=0TO1
780 Q=224*I+14*J:GOSUB820:GOSUB830
790 Q=224*K+14*L:GOSUB820:GOSUB830
800 Q=224*M+14*N:GOSUB820
810 NEXTI:NEXTJ:NEXTK:NEXTL:NEXTM:NEXTN:RETURN
820 FORR=0TO1:POKEP,Q:P=P+1:NEXTR:RETURN
830 POKEP,0:P=P+1:RETURN
900 REM FUNCTION SUBROUTINE
903 DEF FNY(U)=SIN(Y/8*U)*25/U
905 FORY=0TO127:X=INT(FNY(1)+FNY(3)+FNY(5))+45
910 GOSUB230:NEXTY:END
```

The program begins to sketch by getting the key press, which is evaluated in the subroutine starting at line 710. Lines 750 to 760 vary the direction of the cursor, depending on the proper key press. The screen is updated at the subroutine in line 400, and the X and Y coordinates are printed at the top left of the screen.

These coordinates can be useful, especially when the cursor is travelling along a previously drawn line and is therefore invisible. The cube in Photo 1 was made by first drawing a square, and then moving along the border of the square until the X and Y coordinates indicated the cursor was at the corners. A diagonal line was then drawn at each corner, and their ends connected with a second square.

Function Plot

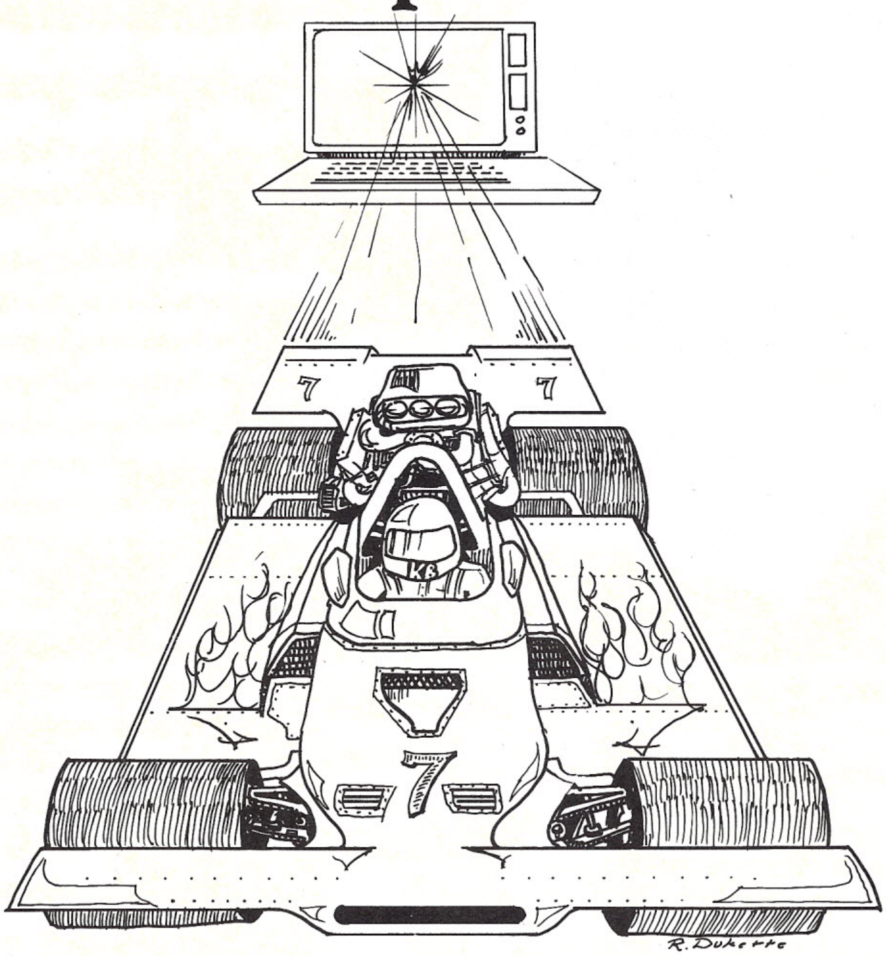
The Function Plot program (Listing 2) is only a modification of the Sketch program. I eliminated the GET function and its evaluation routine and replaced them with a function-generating subroutine at line 900. As an integral part of the program, the user has the option of getting a listing of subroutine 900, modifying it and reentering the program.

Photo 2 is the plot of the subroutine included in Listing 2. Photos 3 and 4 are the plots from the listings of some alternative subroutines.

A nice feature of this program is that you can observe the relationships of various functions by generating one after the other on the same screen. Listing 3, for example, will plot the functions Sin(Y), Cos(Y), Sin(Y)*Cos(Y) and Sin(Y) + Cos(Y). ■

These two game programs test your driving skills and the graphics capability of the C1P.

Hot Rod Graphics



By Dorn Greenwood

These two simple programs, Blockade and Roadrace, are for the Ohio Scientific C1P. Each takes up less than 2K of memory.

In this version, for two players only, each player controls a line (or a blockade), by moving it in any one of four directions (up, down, left or right). The object of the game is to make your opponent either run into your blockade or the boundary. After each collision the clumsy party is given a point against him. The first person to get four points loses.

The first player uses the keys I, L, M and J for up, right, down and left, respectively. The second player uses the keys W, D, X and A.

The blockades will not appear on the screen until a direction key has been pushed. Also, the two players may not go in the same direction at once.

After getting familiar with the graphics on my particular system, I remembered seeing a roadrace program, and thought it would be easy to create my own.

In this game, you are on a winding road and must move to the left or the right to avoid hitting the sides of the road. You're allowed ten crashes to a game. This limit is set in line 205. The object of the game is to get as far as possible in miles before the ten crashes are up.

When the game starts, you must maneuver onto and down the track using the G key for left and H for right. The program has difficulty levels ranging from four to ten. Level ten is easy enough for a blind monkey, while level four is very hard. For users with the CIS ROM IC, add the following line to the program:

13 FOR I=1 to 26:PRINT:NEXT

The program is shorter than others because instead of having the track in data statements, it randomly makes the track different every time.■

Address correspondence to Dorn Greenwood, 15 Grafton Ave., Toronto, Ontario, M6R 2C3, Canada.

Blockade program listing.

```
1 INPUT"RIGHT PLAYER";A
$:INPUT"LEFT PLAYER":B$
2 FORI=53200TO54250:POKE I,32:NEXT
5 POKE 530,1
10 A=54117:Z=54135
11 MO=53379:FOR S=1TO24:MO=MO+32:POKE MO,161:NEXT
12 MO=53411:FOR S=1TO27:MO=MO+1:POKE MO,161: NEXT
13 MO=53436:FOR S=1TO24:MO=MO+32:POKE MO,161:NEXT
14 MO=54173:FOR S=1TO27:MO=MO-1:POKE MO,161:NEXT
15 K=57088:1=127:M=191:N=161
20 POKE K,239:IF PEEK(K)=L THEN  45
```

More

Listing continued.

```
25 POKE K,247:IF PEEK(K)=M THEN 55
30 POKE K,251:IF PEEK(K)=L THEN 65
35 POKE K,253:IF PEEK(K)=M THEN 75
37 IF PEEK(K)=247 THEN 115
39 GOTO 140
45 A=A-32:POKE A,N
46 AA=PEEK(A-32)
47 IF AA=161OR AA=187 THEN 90
50 GOTO 140
55 A=A+1:POKE A,N
56AB=PEEK(A+1)
57 IFAB=161 OR AB=187 THEN90
60 GOTO 140
65 A=A+32:POKE A,N
66 AC=PEEK(A+32)
67 IF AC=161 OR AC=187 THEN90
70 GOTO 140
75 A=A-1:POKE A,N
76 AD=PEEK(A-1)
77 IF AD=161 OR AD=187 THEN90
80 GOTO 140
90 PRINT B$;" CRASHED"
95 C=C+1
97 IF C=4 THEN 260
100 GOTO 2
115 GOTO 2
140 POKE K,239:IF PEEK(K)=253 THEN 190
150 POKE K,247:IF PEEK(K)=251 THEN 200
160 POKE K,251:IF PEEK(K)=251 THEN 210
170 POKE K,223:IF PEEK(K)=191 THEN 220
180 GOTO 20
190Z=Z-32:POKE Z,187
195 BB =PEEK(Z-32)
197 IF BB=161ORBB=187 THEN 230
198 GOTO 20
200 Z=Z-1:POKE Z,187
205 BC =PEEK(Z-1)
207 IFBC=161 OR BC=187 THEN 230
208 GOTO 20
210 Z=Z+32:POKE Z,187
215BD=PEEK(Z+32)
217 IFBD=161ORBD=187 THEN 230
218 GOTO 20
220 Z=Z+1:POKE Z,187
225 BE=PEEK(Z+1)
227 IF BE=161 OR BE=187 THEN 230
228 GOTO 20
230 D=D+1:PRINT A$;" CRASHED":IF D=4 THEN 260
240 GOTO2
260 PRINT TAB(10);"SCORE"
265 PRINT:PRINT A$;" ";D
270 PRINT:PRINT B$;" ";C
300 END
```

Roadrace program listing.

```
1 G=53428
5 H=54030
10 INPUT"HOW DIFFICULT";C
12 FORI=53200TO54250:POKEI,32:NEXTI
15 A =54029:B=A+C
20 J=INT((B-A)*RND(1)+A)
22 IFH+1=JORH-1=J THEN 25
23 GOTO 20
25 H=J
26 POKE J,161
```

More

Listing continued.

```
27 POKE J+C,161
35 PRINT
40 GOSUB 60
45 POKE G,0
47 POKE G-32,32:POKE G-64,32
49 IF PEEK(G+32)=161 THEN 200
50 GOTO 20
60 POKE 530,1
70 K=57088
80 POKEK,247
85 IF PEEK(K)=239THEN 100
90 IF PEEK(K)=247THEN 110
95 RETURN
100 G=G-1:POKE G,0
101 M=M+1
102 IF PEEK(G-1)=161 THEN 200
105 RETURN
110 G=G+1:POKE G,0
111 M=M+1
112 IF PEEK(G+1)=161THEN 200
115 RETURN
200 PRINT"***BANG***"
202 FORI=1TO50:POKE G,232:POKE G,233:NEXT
203 Z=Z+1
205 IF Z=10 then220
210 GOTO 20
220 PRINT"#*#*TEN#*#*"
230 PRINT"YOU WENT ";(M*10);"MILES"
250 END
```

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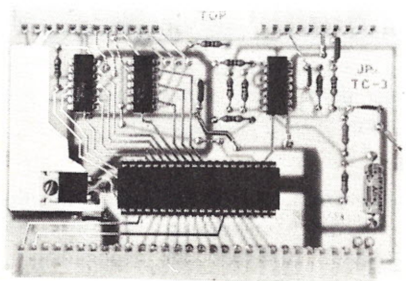

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ENGINEERING AND PRODUCTION CONTROL SYSTEMS

Company founder and president, Walter L. Myers (right), pictured with production engineer Joe Zellers who developed the production control software for the MSI computer system.

THE COMPANY:

MYERS SPRING COMPANY, INC. LOGANSPORT, INDIANA

Myers Spring Company, Inc. was founded 35 years ago by Walter L. Myers for the manufacture of small mechanical springs which are used widely in mechanical appliances, electrical equipment, and by the automotive, construction, and many other industries. The Myers Spring company has grown to several million dollars in annual sales and employs approximately 50 people in its production facility.

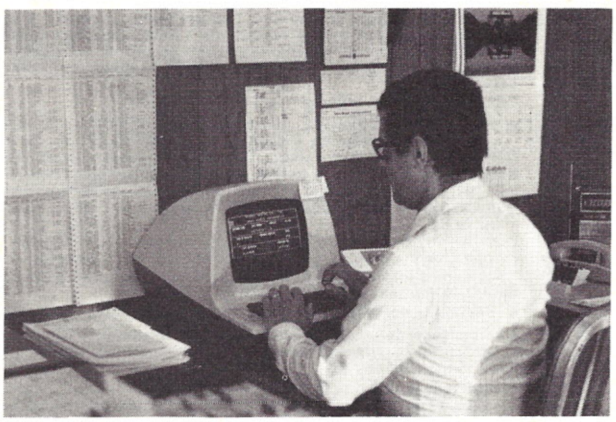
Production engineer Joe Zellers comments, "we began looking at computer systems approximately ten years ago in order to keep up with the increasing demand of order processing, custom mechanical spring design engineering, and production control. In 1975, we selected the MSI system because they were the first company in the microcomputer industry to offer the necessary peripherals which would convert a microcomputer system into a usable business system. Since 1975, the MSI system has been expanded to accommodate four users simultaneously, performing a variety of plant monitoring functions and management programs."

"The system is equipped with 10 megabytes of hard disk storage presently and we plan to add an additional 10 megabytes of storage soon. The maximum downtime has been only one or two days in the 5 years that the system has been in operation. MSI has provided excellent technical support and willingness to help us with our special requirements. We have nothing but praise for MSI, they have provided excellent system support."

SPRING ENGINEERING AND DESIGN

"All of the production at Myers Spring is performed to exact customer specifications rather than to the manufacture of standard spring products. This causes an ever increasing demand for quick and efficient design and engineering capabilities. Many parameters have to be taken into consideration in the design of any particular spring, including wire size, wire type, material modulus, spring diameter, number of turns per inch, free length, spring loading, rate, solid height, working stress, working temperature, number of operating cycles, hysteresis, resonant frequency, expansion, and whether the spring has to be ground or not. It used to take over an hour for an engineer to design a spring taking into account all of these parameters. However, with the engineering software which we have developed for the MSI system, spring design can be completed in less than one minute by simply keying in the desired parameters. The MSI computer system not only designs the spring for us but prepares a complete quotation for the customer after consideration of the material to be used, the amount of waste, which equipment the production will use, the speed of the machines, the necessary labor rate, as well as the desired percentage of profit."

The production facility at Myers Spring Co. is equipped with many automated machines for mechanical spring production.



One of four workstations where design engineering, checking of sales order status, and production control monitoring is performed.

SALES QUOTATION SYSTEM

Following the computer spring design procedure, with automatic quotation feature, the actual production begins. Each quotation is reviewed and compared to actual job cost reports on the production run in order to make any necessary refinements in the quotation system software. This feature of our system has greatly improved our ability to prepare accurate quotations and to insure profitability of the company.

PRODUCTION CONTROL/JOB COST ACCOUNTING

Each production work order is tracked by the computer system at each stage of the production process. First, each order is checked against the customer quotation for accuracy. As each order is processed, exact shop labor time is recorded, for each production machine used, and each stage of the production process. Summary reports are produced showing the total amount of material used, time used on each production machine, amount of material used, and a total cost figure for each work order.

SALES SUMMARY REPORTS

The system is designed to produce monthly sales summaries which show the amount of products sold by each salesman, complete with dates, order numbers, type of product, quantity, type of material, material cost, sales commissions, etc. Totals for each desired category and for each salesman are reproduced.

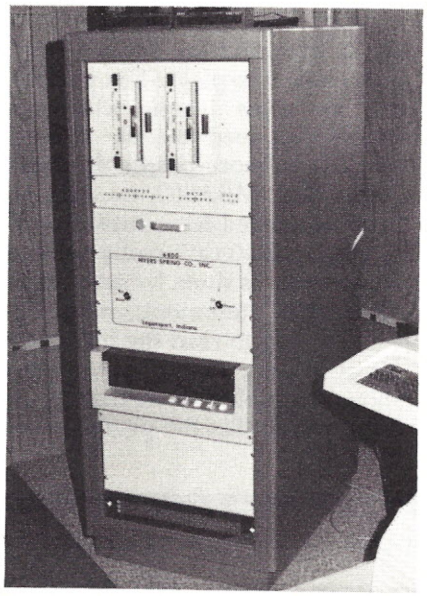
ACCOUNTS RECEIVABLE SYSTEM

Each morning, invoices are generated for orders which will be shipped that day. The accounts receivable system maintains accounts for over 500 active customers. The system produces monthly statements complete with aging of open invoices.

MULTI USER CAPABILITY

The MSI system is equipped with four user terminals presently which are available for use simultaneously by the following departments: Order department, for entering new orders and checking order status. Inventory department, used for checking to see whether a particular product has been produced previously. Invoicing/Cost Accounting, used for preparation of invoices and for entry of labor and material cost accounting information. Design Engineering, used by company engineers to design new products.

Order entry, invoicing, monthly statements, and other management reports are carried out at this workstation at Myers Spring Co.



The MSI system at Myers Spring Company is equipped with 10 megabytes of hard disk memory, dual floppy disk drives, a high speed printer, and four user CRT terminal workstations.

GENERAL LEDGER TIE-INS

The MSI system automatically prepares journals for cost accounting information and sales data which can then be posted to the general ledger. Complete income statements and balance sheets are produced by the general ledger programs on the system.

MULTIPLE MANAGEMENT REPORTS

The MSI system is used in many different areas of the company in order to provide more efficient and effective management of our production facilities. Several of the reports which we obtain from the system are: **production schedules, due list for orders, new orders list, production summary by department, salesman's reports, individual customer reports and order histories, time studies, sales quotations, design engineering, sales summaries, customer statements, general ledger balance sheet and income statements.**

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MSI ...... Helping to make your business run better.

You'll make a wise investment with this Microsoft Disk BASIC program that gives you portfolio values at a glance. Part 1.

Put Your Micro On Wall Street

By Dex Hart

PORTVAL is a short program written in Microsoft BASIC to simplify periodic evaluation of a common stock portfolio. If you are an experienced programmer, you may want to skip to something more complicated, like "Fourier Analysis of Three-Dimensional Boolean Hopscotch." Mine is simple stuff, because I'm relatively new to the game.

My advantage is that I remember every place I got hung up when I started, and I'll try to help those of you to whom this program is not instantly obvious. It doesn't really matter if you don't have a big, fat portfolio. Follow this program through and learn how to do at least *something* genuinely useful with BASIC. The forms used have wide general application.

This program lets you list your common stocks along with the purchase date, number of shares and initial investment. Every time you update current share prices (perhaps ten minutes total time for a dozen stocks *including* looking up prices in the morning paper), the program calculates current value, dollar difference between current value and initial cost for each stock and percentage gain for each stock from the date of purchase. Initial cost and current value are totaled, and the total dollar difference is shown along with the percentage gain or loss for the total list.

The sample run, for which I have arbitrarily selected five stock issues, clearly illustrates the output. The prices are real; the numbers of shares are for illustration only. Imagine what you'd have if you had hocked everything but your spouse and put it all in Humana in early 1977.

I live in Miami and am not a member of a computer club (the only one I know of locally is a hard-core Apple group). That makes learning a high-level language somewhat tougher. I decided to read several different BASIC books, on the theory that each author covers slightly different stuff. Good idea, and I ended up nominally "literate" in BASIC (I could generate nice tables of cubes, square roots and trig functions). But I *couldn't* write my portfolio program.

Value Line Investment Survey offered a free program to its computer-owning subscribers, a very simple program for 4K memory machines, listing Value Line ratings of timeliness, safety, and so forth. Lightning struck when I saw what they did with "print using." Microsoft literature shows many forms of print using, but each example is for a single string or numerical quantity. Turns out you can format a whole line with this command. I'll run through the program quickly and then elaborate on how to use print using, tossing in some other comments on using MBASIC along the way.

The Program

You enter the number of stocks, n, on line 30. Originally I dimensioned each variable in line 50 to the specific number before I realized you could use n; much neater. Lines 40 and 50 only come into play when you use array variables (those with parentheses) and need to count more than ten (ten or more passes through the loop). With MBASIC, no DIM statement is needed for a subscript of 10 or less. Line 40 isn't really necessary, as no harm is done by an unneeded dimension statement; lines 70–90 show a loop to read the infrequently changed data. The list of variables is shown in Table 1. Note that the thimble I used to list the program on my

```
'PORTVAL'......... Portfolio Valuation.....Prices as of 31 Dec 80

   Stock          Date  Shares Cost  Price  Value    Diff   %Gain

 1 Carlisle     29Sep80  160   9991  84.0   13440    3449    34.5
 2 Crown Cork   18Mar71  100   2231  28.4    2840     609    27.3
 3 Humana        7Mar77  900   4900  71.4   64260   59360  1211.4
 4 Kysor        18Dec69  200   2758  10.6    2120    -638   -23.1
 5 Travelers     2Dec68  100   3511  38.9    3890     379    10.8
*****************************************************************
Totals                        23391         86550   63159   270.0
```

Sample run.

Address correspondence to Dex Hart, 9414 SW 142 St., Miami, FL 33176.

Spinwriter makes parentheses look a bit like brackets. They are not.

When I first wrote the program, I was pretty dense. I wrote it in what I now call "column input," meaning you read in data one column at a time, as opposed to "row input." Each of the variables in line 80 had to have its own loop and the DATA statements were all of a kind: first n stock names, then n dates, and so on. It works, but it's a bitch when you want to change a stock (as when you buy or sell). I had to count into a massed hunk of numbers to enter or excise data.

A$—stock name
D$—purchase date
S—number of shares
C—initial total cost (not per-share cost) in dollars
P—current price (dollars and tenths of dollars)
V—current value (P times S)
D—dollar difference (V minus C)
G—percentage gain or loss
D1$—current date to be typed on the hard copy for records' purposes
T1—total of the C column
T2—totals of the V column
T3—difference (T2 minus T1)
T4—overall percentage gain or loss

Table 1. List of variables.

With row input as shown, each stock has its own line. Want to sell Kysor? Delete line 130. Add Texaco? Enter the four data items on a new line 135. Type RENUM and your numbers are back to the start 10/increment 10 shown on my listing, chosen, by the way, so you can use the AUTO line numbering function on disk MBASIC.

For inputting the current price I go back to column input (data on line 190). Just enter n prices in order; take as many lines as needed. Enter the date of the prices, D1$, as item n + 1. For large portfolios, data lines of ten items each make keeping track easier. This program is especially easy to follow because it doesn't jump around with GOTOs and branching: two sets of READ-DATA lines, then the arithmetic section inside its own loop (lines 210–290), then print to screen (lines 310–490), and finally the hard-copy section if you so elect (lines 510–730). Keeping LPRINT lines clustered in one spot makes it easier to include or skip the hard-copy operation.

Note on line 510 that there is a comma before J instead of the usual semicolon. The semicolon causes the machine to print a question mark; the comma suppresses the question mark. A couple of blanks following the word RETURN moves the cursor over so the final word is more easily read. These are minor, but interesting, items. Note that you can print a string to the screen inside the INPUT statement. You don't have to PRINT the string and then follow with the INPUT line.

Line 300 is a clear screen command (for my Superbrain); your machine may be different or you may have a CLS command (TRS) to do the same thing. It's not necessary, but if you are listing a short portfolio, you get rid of any leftover listing clutter at the top of the screen. In MBASIC (and others,), a remark can be added to a command line (as on line 300) by preceding it with an apostrophe. This doesn't work on DATA lines. The price date entered on line 190 is printed on the screen (line 310) and on the hard copy (line 550).

Print Using

PRINT USING (and LPRINT USING) are the keys to putting a lot of columns on a page, exactly where you want them, and in the format in which you want them (rounded and decimal places as specified). You can format the whole line by using separate lines followed by a semicolon to keep the machine from line-indexing (as I did on the listing), or you can spread all the formatting out on one line if you so choose. In other words, lines 410–440 could be replaced by the single line:

```
410 PRINT USING"##.# ##### ##### ####.#
    ";P(I);V(I);D(I);G(I)
```

Spacing is determined by the number of blanks between the "number" symbols which represent digits, or by the number of blanks between the symbols and the close-quote mark. If you don't allow enough room (if the number to be printed is too big), the machine will prefix the number with a percent sign. Fix it. Lines 480–490 show two format columns on each line. They could have been written as one line or as four, with the first three terminating in semicolons.

Backslashes identify the string format. Backslash–eight spaces–backslash allows a ten-character string. The two sets of backslashes (lines 370–380) are for A$(I) stock name and D$(I) purchase date. Characters beyond the space allocated are discarded. Note on lines 100–140 that strings need not be within quotation marks in MBASIC, unless left justification is not satisfactory. Where the day of the month is a single digit, I used quote marks to retain the leading blank so that the month and year line up properly on the printed table.

Other minor items: underlining lines (I used asterisks) such as line 460 could be split in two. Just terminate the first half with a semicolon following the close-quote. Line 330 could likewise be split. In line 480, the "tab (n-spaces)" simply starts the printing that far from the left margin. More blank spaces following the

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open-quote mark would have accomplished the same thing—just not quite as neatly.

If the column headings in line 330 don't line up with the columns, move things about until they do. Do this tidying on the screen, not on the hard-copy lines. When the screen version is perfect, then do a virtual copy for the LPRINT section. I find it easiest to initially number the LPRINT lines 1000 higher than their matching PRINT line. And I use EDIT 330 instead of LIST 330 be-

```
10 REM ******  "PORTVAL"  ******
20 CLEAR
30 N=5
40 IF N<=10 GOTO 60
50 DIM A$(N),D$(N),S(N),C(N),P(N),V(N),D(N),G(N)
60 RESTORE
70 FOR I=1 TO N
80 READ A$(I),D$(I),S(I),C(I)
90 NEXT I
100 DATA Carlisle, 29Sep80,160,9991
110 DATA Crown Cork,18Mar71,100,2231
120 DATA Humana," 7Mar77",900,4900
130 DATA Kysor,18Dec69,200,2758
140 DATA Travelers," 2Dec68",100,3511
150 FOR I=1 TO N
160 READ P(I)
170 NEXT I
180 READ D1$
190 DATA 84.0,28.4,71.4,10.6,38.9,30 Dec 80
200 T1=0:T2=0:T3=0:T4=0
210 FOR I=1 TO N
220 V(I)=S(I)*P(I)
230 D(I)=V(I)-C(I)
240 G(I)=100*D(I)/C(I)
250 T1=T1+C(I)
260 T2=T2+V(I)
270 T3=T3+D(I)
280 T4=100*T3/T1
290 NEXT I
300 PRINT CHR$(12)       'clear screen
310 PRINT"'PORTVAL'  ......  Portfolio Valuation....prices as of ";D1$
320 PRINT
330 PRINT"   Stock        Date  Shares  Cost  Price  Value    Diff   %Gain"
340 PRINT
350 FOR I=1 TO N
360 PRINT USING"##  ";I;
370 PRINT USING"\          \  ";A$(I);
380 PRINT USING"\     \  ";D$(I);
390 PRINT USING"###  ";S(I);
400 PRINT USING"#####  ";C(I);
410 PRINT USING"##.#   ";P(I);
420 PRINT USING"#####   ";V(I);
430 PRINT USING"#####  ";D(I);
440 PRINT USING"####.#";G(I)
450 NEXT I
460 PRINT"**************************************************************"
470 PRINT "Totals";
480 PRINT TAB(29)USING" ######         ######   ";T1;T2;
490 PRINT USING"#####   ###.#";T3;T4
500 PRINT

510 INPUT "Hard copy?—YES enter 1 (printer on!)—NO hit RETURN  ",J
520 IF J=1 THEN 550 ELSE 540
530 GOTO 550
540 END
550 LPRINT"'PORTVAL'......... Portfolio Valuation.....Prices as of ";D1$
560 LPRINT
570 LPRINT"   Stock        Date  Shares Cost  Price  Value    Diff   %Gain"
580 LPRINT
590 FOR I=1 TO N
600 LPRINT USING"## ";I;
610 LPRINT USING"\          \  ";A$(I);
620 LPRINT USING"\     \  ";D$(I);
630 LPRINT USING"###  ";S(I);
640 LPRINT USING"#####  ";C(I);
650 LPRINT USING"##.#   ";P(I);
660 LPRINT USING"#####   ";V(I);
670 LPRINT USING"#####  ";D(I);
680 LPRINT USING"####.#";G(I)
690 NEXT I
700 LPRINT"**************************************************************"
710 LPRINT"Totals";
720 LPRINT TAB(28)USING" ######         ######   ";T1;T2;
730 LPRINT USING"#####   ###.#";T3;T4
740 GOTO 540
```

Program listing. PORTVAL stock portfolio program in Microsoft BASIC.

✓See List of Advertisers on page 194

cause the edit (hit the return again to print the line) doesn't leave an "OK" or "ready" line in between. Then when I type 1330, it is easier to copy the line now directly above; I just substitute the hard-copy LPRINT for the screen-copy PRINT command.

The purpose of the plus-1000 numbering is to make the many initial spacing adjustments easier. If you have trouble on line 1420, you know you can solve it by comparing it to line 420. Once you've got screen and hard-copy spacing down it will never have to be changed—unless your portfolio grows so much you have to add more room for those larger numbers!

After you've checked the hard-copy layout and made any minor spacing corrections necessary, you can RENUM. For those of you who haven't used the RENUM command, learn it. It not only renumbers line numbers, but automatically changes any GOTO or IF-THEN-ELSE numbers. It is a joy to watch.

Before I figured out that I could use PRINT USING to format neat tables, I thought I had to have VisiCalc or T-Maker to make a many-columned table with "field arithmetic" operations. Not so. Once you understand this program you can make most tables you need. Most arithmetic commands are fairly obvious, and in addition to those shown here, you can average, calculate weighted averages and do other common manipulations. One operation that may not seem simple at first glance is totaling a column. Look at line 250: T1 = T1 + C(I). This is the command to total all the initial dollar costs. It wasn't obvious to me. If it's not to you, I'll lay out a numerical example that I found helpful.

Totaling a Column

Assume you have three numbers: C(1) is 5; C(2) is 7; C(3) is 6. In a loop, where n = 3, you would say "FOR I = 1 to N/T1 = T1 + C(I)/next I." OK. Initially T1 is zero (as you said in line 200). So for the first pass, T1 = zero + C(1) or zero + 5. You're really saying the *new* T1 is the sum of the *old* T1 plus some number (identified to the computer by its subscript i). The machine indexes and makes pass number 2; the *current* T1 is now 5 and you say the next T1 = 5 + C(2) or 5 + 7. After two passes, the "newest" T1 is 12.

One more pass. T1 will become the existing T1 (that is, 12) plus C(3). The most up-to-date T1 becomes the second pass T1 plus 6, or 12 plus 6. Yes, I know you did it in your head. And you're right: the final value of T1 is 18. What the machine will call T1 (and will print when you call for T1) is the final, or most recent, value. That's what is stored in its electronic pigeonhole labeled T1.

Stock split? Just change shares, S, for the stock involved, use the new lower price. No other change is necessary, as the total initial dollar cost is, of course, unchanged. No special effort has been made to identify stocks as long-term or short-term. Since the holding period is currently one year, a glance at the acquisition date makes the status obvious. Active traders, for whom this tax status is a key consideration, may want to run separate portfolios of long- and short-term stocks, switching listings as necessary. I find it helpful to list stocks alphabetically by exchange to make looking up prices faster. First NYSE, then American, then over-the-counter.

Coming Attractions

Next month I'll give you an even shorter program called TIMEGAIN, which will demonstrate how to CHAIN to another program, passing selected variables to it. TIMEGAIN has no variables of its own. If you have several different portfolio valuation programs, you can run TIMEGAIN with any of them, with no data additions ever. This is done by storing some "old" price data in a revised PORTVAL, even though it is not used there. It's just easier to do it that way.

What is TIMEGAIN? It evaluates the performance of your portfolio over a fixed time period, not from the varying purchase dates of your stocks. You can, for example, follow dollar differences and percentage gains from the last day of one month to the last day of the next. It answers the question, "But what have my stocks done for me lately?" Just because it seemed like a nice idea, I've also added a "percent of portfolio" column.

These are simple programs which will not make buy-or-sell decisions, but will make it easy for you to see long-term and current performance, for individual stocks as well as for the total portfolio. The key idea is that updating is so easy, you'll do it on a regular basis. Your decisions should be better simply because you have up-to-date management information, nicely presented.■

See List of Advertisers on page 194

Clock/Calendar For the 6809

By David R. Rawson

This digital calendar/clock will keep track of the current time and supply all information from the year to the second. This even includes the day of the week. A small rechargeable Nicad battery pack keeps the clock functioning during computer off-time.

The described application is for a 6809 processor running under Flex 9.0; however, it should be easy to adapt to other systems and processors.

Two listings provide the software for Flex 9.0 support. Listing 1 shows the method of setting the clock initially and after a power loss.

The amount of support electronics required is small, consisting of a parallel interface and a few resistors and capacitors.

The complete circuit (see Fig. 1) was assembled on a Percom I/O prototype board for the SS-50 bus. There are only three ICs on the board, including the power supply. The largest is a 6821 PIA (parallel interface adapter), which interfaces the clock to the computer bus, handling data, control and address information for the clock circuit. The next is the MSM5832 calendar/clock IC, which requires a 32.768 kHz crystal similar to the type used in digital watches. The last IC is an LM340T-5 regulator for the 5-volt supply.

The heart of the clock is the MSM5832 microprocessor real-time clock/calendar IC made by OKI Semiconductor, 1333 Lawrence Expressway, Santa Clara, CA 95051. I chose this IC because it interfaces easily to the 6809, requires minimal software and has many features. Some of these features include a leap year register, 12- or 24-hour format, a single 5-volt supply, a reliable battery backup (to Vcc = 2.2 volts), low power dissipation (2.5 mW max.) and an 18-pin DIP package.

This IC greatly simplifies the circuit when compared to other designs recently published. No level shifting is required when connecting any of the data, control or address lines to TTL-compatible loads. Also, the clock has a hold function that stops operation during a read or write; this prevents confusing updates of data. The register data is static and no digit scanning is used. This means that any digit is available for reading at any time.

The MSM5832 can also generate timed interrupts. Table 1 gives the list of conditions and possible intervals. When using a PIA as the interface, you can simply connect the desired output to the appropriate interrupt line (CA1, CB1). The selection of the rate could even be under software control by using the spare I/O

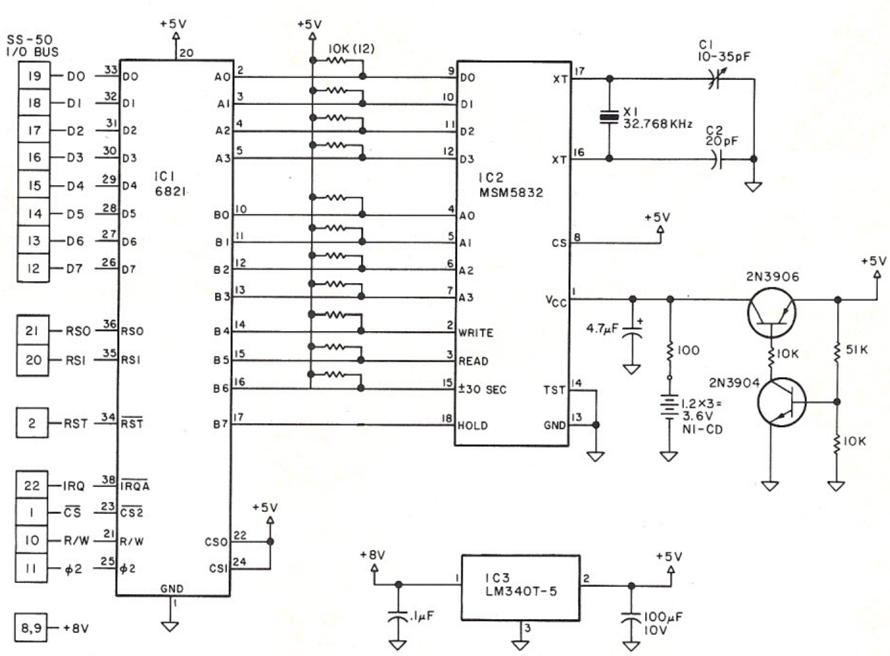

Fig. 1.

David R. Rawson, 1825 Gary, Wichita, KS 67219, is a computer hobbyist and flight simulator technician.

lines and a switching circuit. I don't use this as yet, but I do plan to incorporate it in the future.

Hardware Design

The schematic is shown in Fig. 1. The PIA connections to the I/O bus are standard; however, I have labeled the functions and pin numbers on the schematic. The A side of the PIA is used for data transfers to and from the clock IC. It is configured as an input or output depending on the current function. It connects to the four clock-data lines. The high-order data lines are unused and their status is masked during a read.

The B side of the PIA is divided into two four-bit parts. The low-order bits are used to address the registers in the clock, and are therefore connected to the address lines. The high-order bits are used for controlling the hold, read and write functions. All of the data, address and control lines are tied to +5 through a 10k resistor, since they are tied low by the clock IC. The crystal and load capacitors connect to pins 16 and 17 to complete the oscillator circuit.

C1 allows minor trimming of the 32.768 kHz oscillator. The chip select pin labeled $\overline{CS}$ (8) ties directly to +5. This is because the threshold on this pin is set higher than any other pin. This means that when the computer is turned off and the power supply drops to zero, the chip is deselected and the I/O pins are placed in the high-impedance state before anything can accidentally be changed by a processor in its death throes.

A two-transistor regulator charges the Nicads and supplies about 4.4 V to the clock IC. I used three 2/3 AA batteries for the backup supply. These require about 50 mA charge current for 14 hours to reach full charge. You can charge them prior to installation (be sure the circuit is ready to have power applied) or you can run the computer for a while to build up a good charge. I found the latter to be far more enjoyable. Either way, with a full charge, several months of standby operation is possible.

Construction is simple, using number 30 wire-wrap wire and point-to-point wiring. Component layout is not critical, so I oriented the ICs for the shortest distance between interconnected pins.

When the clock is completed, a frequency counter can be used to check and correct the 32.768 kHz oscillator using C1. This can be done with the board out of the computer, as accuracy only varies ±2 ppm between normal and battery operation.

Software Interface

The software required to make the clock operational is fairly simple and straightforward. Listing 1 is the program to set the clock. The label CLOCK refers to the address of the board. I used slot 4, so the address is $E010. Two Flex routines, GETCHR and PSTRNG, are used for communication with the operator's terminal. The following is a description of the flow of the program.

First, the PIA is initialized and set up with the A and B sides' outputs. Also, a check is run to see if a board has been installed in the computer. If one is not found the program states this and returns to Flex.

If all is OK so far, then each of the particulars for the current time is asked for. As each is input, it is compared to its maximum and checked to be sure it is a number, to catch input errors.

The operator is also asked if this is a leap year. If the answer is yes, then the proper bit is set in the D10 digit. I only use the 24-hour mode, so the proper flag is set in the H10 digit. Table 2 shows each register address, its limits and any special function bits.

After all data is entered, the opera-

Conditions	Output	Reference Frequency	Pulse Width
HOLD=L	D0	1024 Hz	50% duty
READ=H	D1	1 Hz	122.1 us
CS=H	D2	1/60 Hz	122.1 us
A0–A3=H	D3	1/3600 Hz	122.1 us

Note: 1024 Hz signal not affected by HOLD input. Others stop during HOLD.

Table 1. Clock/calendar registers, limits and data.

A3	A2	A2	A0	Counter	D3	D2	D1	D0	Limits	Notes
Address Inputs					Data I/O					
0	0	0	0	S1	X	X	X	X	0 to 9	S1 and S10 set to 0 on write.
0	0	0	1	S10		X	X	X	0 to 5	
0	0	1	0	MI1	X	X	X	X	0 to 9	
0	0	1	1	MI10		X	X	X	0 to 5	
0	1	0	0	H1	X	X	X	X	0 to 9	
0	1	0	1	H10	+	+	X	X	0 to 1/0 to 2	D2=1 for PM D3=1 for 24 hr D2=0 for AM D3=0 for 12 hr
0	1	1	0	W		X	X	X	0 to 6	days from Sunday
0	1	1	1	D1	X	X	X	X	0 to 9	
1	0	0	0	D10		+	X	X	0 to 3	D2=1 for leap year
1	0	0	1	M01	X	X	X	X	0 to 9	
1	0	1	0	M010				X	0 to 1	
1	0	1	1	YR1	X	X	X	X		
1	1	0	0	YR10	X	X	X	X		

Note: + = special function bits
X = significant bits

Table 2. Interrupt timer data.

tor is asked if he would like to reenter data for any mistakes. No data has been written to the IC at this point, so the entire entry sequence is repeated for a yes answer. A no answer will load data into the clock and will hold it there until released. This lets you synch it to some standard like WWV.

Listing 2 shows how Flex 9.0 is modified so that the clock chip is read for the start-up information instead of the normal operator entry. The first portion supplies the jump to the new sequence from the old one at $CA50. The PIA is then initialized as before, and the same check is made for an installed board. If no board is found, then the standard start-up sequence is used.

Assuming a board is in place, the clock data is then read into a buffer area. As each register is read it is masked to remove erroneous data bits. The appropriate numbers are moved to the Flex constants SYSDAY, SYSMON and SYSYR. Finally, each is output to the terminal as follows:

(HOME,CLEAR)
SIGN ON

The following is a list of suppliers and costs as of this writing for the main components.

Name	Address	Part	Catalog No.	Cost
Digi-Key Corp.	PO Box 677 Hiway 32 South Thief River Falls MN 56701	MSM5832 Crystal	MSM5832 KF36G	9.80 2.70
Percom Data	211 N. Kirby Garland, TX 75042	Proto Board		14.95

Listing 1.

```
*********************************************************
*********************************************************
**                                                     **
** THIS PROGRAM IS USED TO INITIALLY SET THE CLOCK/     **
** AND CALENDAR . IT  MAY ALSO BE USED IF SOME TYPE    **
** OF POWER OUTAGE HAS CAUSED THE CHIP TO LOSE DATA.   **
**                                                     **
**  THE PROGRAM ASSUMES THAT THE BOARD IS INSTALLED    **
** IN PORT #4 AT ADDRESS $E010, HOWEVER IF NO BOARD    **
** IS INSTALLED THE PROGRAM WILL SO STATE AND EXIT     **
** TO FLEX GRACEFULLY.                                 **
**                                                     **
**  ALL DATA MUST BE ENTERED AS TWO DECIMAL DIGITS.    **
** NUMBERS <10 SHOULD BE PREFACED WITH A '0'.          **
**   AUGUST 7,1980 WOULD BE ENTERED AS FOLLOWS         **
** (YEAR ? 19)80                                       **
** (MONTH?) 08                                         **
** (DAY  ?) 07                                         **
** PRINTING IN BRACKETS ARE THE COMPUTER PROMPTS       **
** DAY OF WEEK FROM SUNDAY REFER TO NUMBER OF DAYS     **
** PAST. EX FOR THURSDAY ENTER 4  (THIS IS A SINGLE    **
** DIGIT)                                              **
** HOUR IS IN 24 HOUR FORMAT SO 6:00 PM IS HOUR 18.    **
** SET MINUTES TO 1 OR 2 FROM PRESENT THEN TYPE ANY    **
** CHARACTER AT THIS MINUTE TO SYNC THE CLOCK.         **
**                                                     **
*********************************************************
*********************************************************

                      * FLEX ROUTINES *

              CD1E   PSTRNG  EQU    $CD1E
              CD15.  GETCHR  EQU    $CD15
              CD03   WARMS   EQU    $CD03

                      * EXTERNAL EQUATES *

              0001   VERSION EQU    1

              E010   CLOCK   EQU    $E010

C100                         ORG    $C100

                      * MAIN PROGRAM *

C102 01                      FCB    VERSION
C103 17    00B4      TIME1   LBSR   INIT
C106 24    0A                BCC    OK2         IF SET THEN NO BOARD
C108 30    8D 011C           LEAX   NOBD,PCR
C10C BD    CD1E              JSR    PSTRNG      REPORT THIS
C10F 7E    CD03              JMP    WARMS       EXIT
C112 30    8D 0100   OK2     LEAX   INTRO,PCR
C116 BD    CD1E              JSR    PSTRNG
C119 31    8D 01BF           LEAY   BLOCK,PCR LIST OF MAX FOR EACH DIGIT
C11D 30    8D 0120           LEAX   YEAR,PCR
C121 BD    CD1E              JSR    PSTRNG
C124 8D    70                BSR    GET2
C126 30    8D 0120           LEAX   MONTH,PCR
C12A BD    CD1E              JSR    PSTRNG
C12D 8D    67                BSR    GET2
C12F 30    8D 0120           LEAX   DAY,PCR
C133 BD    CD1E              JSR    PSTRNG
C136 8D    5E                BSR    GET2
C138 30    8D 0120           LEAX   DOW,PCR
C13C BD    CD1E              JSR    PSTRNG
C13F 8D    51                BSR    GET1
C141 30    8D 0129           LEAX   HOUR,PCR
C145 BD    CD1E              JSR    PSTRNG
C148 8D    4C                BSR    GET2
C14A 30    8D 0129           LEAX   MINUTE,PCR
C14E BD    CD1E              JSR    PSTRNG
C151 8D    43                BSR    GET2
C153 30    8D 0129           LEAX   LPYR,PCR
C157 BD    CD1E              JSR    PSTRNG
C15A BD    CD15              JSR    GETCHR
C15D 81    59                CMPA   #'Y
C15F 26    08                BNE    ON1         IF LEAPYEAR SET CLOCK BIT
C161 B6    C2E0              LDA    DAY10
```

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Z80B	CPU	21.00

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Z80A-DMA	22.50
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Z80A-S10/0	22.50
Z80-S10/1	18.50
Z80A-S10/1	22.50
Z80-S10/2	18.50
Z80A-S10/2	22.50
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8216	1.85
8224	2.65
8226	1.85
8228	5.00
8238	5.45
8243	4.65
8251A	5.55
8253	9.85
8255A	5.40
8255A-5	5.40
8257	9.25
8257-5	9.25
8259A	7.30
8271	60.00
8275	32.95
8279	10.80
8279-5	10.80
8282	6.70
8283	6.70
8284	5.85
8286	6.70
8287	6.70
8288	25.40
8289	49.95

8755	49.95
4000	.35
4001	.35
4002	.35
4006	1.39
4007	.29
4008	1.39
4009	.49
4010	.49
4011	.35
4012	.29
4013	.49
4014	1.39
4015	1.15
4016	.59
4017	1.19
4018	.99
4019	.49
4020	1.19
4021	1.19
4022	1.15
4023	.38
4024	.79
4025	.38
4026	2.50
4027	.65
4028	.85
4029	1.29
4030	.45
4031	3.25
4032	2.15
4033	2.15
4034	3.25
4035	.95
4037	1.95
4040	1.29
4041	1.25
4042	.95
4043	.85
4044	.85
4046	1.75
4047	1.25
4048	.99
4049	.69

4050	.69
4051	1.10
4052	1.10
4053	1.10
4055	3.95
4056	2.95
4059	9.95
4060	1.39
4066	.75
4068	.35
4069	.35
4070	.49
4071	.35
4072	.35
4073	.35
4075	.35
4076	1.29
4078	.35
4081	.35
4082	.35
4085	1.95
4086	.79
4093	.99
4099	2.25
4104	1.99
4501	.39
4502	1.65
4503	.69
4505	8.95
4506	.75
4507	.95
4508	3.95
4510	1.39
4511	1.39
4512	1.39
4514	3.95
4515	3.95
4516	1.69
4519	.99
4520	1.39
4522	.99
4526	1.15
4527	1.75
4528	.99

4531	.99
4532	1.25
4539	.99
4543	1.99
4553	3.50
4555	.75
4556	.75
4581	1.99
4582	1.01
4584	.55
4585	.99
4702	9.95
74C00	.39
74C02	.39
74C04	.39
74C08	.49
74C10	.49
74C14	1.65
74C20	.39
74C30	.39
74C32	.99
74C42	1.85
74C48	2.39
74C73	.85
74C74	.85
74C85	2.49
74C89	4.95
74C90	1.85
74C93	1.85
74C95	1.85
74C107	1.19
74C151	2.49
74C154	3.50
74C157	2.10
74C160	2.39
74C161	2.30
74C163	2.39
74C164	2.39
74C173	2.59
74C174	2.75
74C175	2.75
74C192	2.39
74C193	2.39
74C195	2.39

74C925	6.95
74LS00	.35
74LS01	.28
74LS02	.28
74LS03	.28
74LS04	.39
74LS05	.28
74LS08	.39
74LS09	.39
74LS10	.28
74LS11	.39
74LS12	.39
74LS13	.47
74LS14	1.25
74LS15	.39
74LS20	.26
74LS21	.38
74LS22	.38
74LS26	.39
74LS27	.39
74LS28	.39
74LS30	.26
74LS32	.39
74LS37	.79
74LS38	.39
74LS42	.79
74LS47	.79
74LS48	.79
74LS51	.26
74LS54	.35
74LS55	.35
74LS73	.45
74LS74	.59
74LS75	.68
74LS76	.45
74LS78	.65
74LS83	.99
74LS85	1.19
74LS86	.45
74LS90	.75
74LS92	.75
74LS93	.75
74LS95	.88
74LS96	.98

74LS107	.45
74LS109	.45
74LS112	.49
74LS122	.55
74LS123	1.19
74LS125	1.35
74LS126	.89
74LS132	.79
74LS136	.59
74LS138	.89
74LS139	.89
74LS145	1.25
74LS148	1.49
74LS151	.79
74LS153	.79
74LS155	1.19
74LS156	.99
74LS157	.99
74LS158	.75
74LS160	.98
74LS161	1.15
74LS162	.98
74LS163	.98
74LS164	1.19
74LS165	.89
74LS166	2.49
74LS170	1.99
74LS173	.89
74LS174	.99
74LS175	.99
74LS181	2.20
74LS190	1.15
74LS191	1.15
74LS192	.98
74LS193	.98
74LS194	1.15
74LS195	.95
74LS196	.89
74LS197	.89
74LS221	1.49
74LS240	1.95
74LS241	1.90
74LS242	1.95
74LS243	1.95

74LS244	1.95
74LS245	4.95
74LS247	1.10
74LS248	1.10
74LS249	1.69
74LS251	1.79
74LS253	.98
74LS257	.98
74LS258	.98
74LS259	2.95
74LS260	.69
74LS261	2.49
74LS266	.59
74LS273	1.75
74LS275	4.40
74LS279	.59
74LS283	1.10
74LS290	1.29
74LS293	1.95
74LS295	1.10
74LS298	1.29
74LS324	1.75
74LS347	1.95
74LS348	1.95
74LS352	1.65
74LS353	1.65
74LS363	1.49
74LS365	.99
74LS366	.99
74LS367	.73
74LS368	.73
74LS373	2.75
74LS374	2.75
74LS375	.69
74LS377	1.95
74LS385	1.95
74LS386	.65
74LS390	1.95
74LS393	1.95
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Listing 1 continued.

```
C164 8A    04                  ORA    #$4         BIT IS IN MONTH DATA
C166 B7    C2E0                STA    DAY10
C169 B6    C2E3       ON1      LDA    H10         24 HOUR FORMAT ONLY
C16C 8A    08                  ORA    #$8         SO SET BIT IN HOURS
C16E B7    C2E3                STA    H10
C171 30    8D 014C             LEAX   ERROR1,PCR WANT TO REDO
C175 BD    CD1E                JSR    PSTRNG
C178 BD    CD15                JSR    GETCHR
C17B 81    59                  CMPA   #'Y
C17D 27    84                  BEQ    TIME1
C17F 8D    5E                  BSR    SET         PUT DATA IN CLOCK
C181 30    8D 0106             LEAX   START,PCR
C185 BD    CD1E                JSR    PSTRNG
C188 BD    CD15                JSR    GETCHR      DON'T RELEASE CLOCK UNTIL TOLD TO
C18B 4F                        CLRA
C18C B7    E012                STA    CLOCK+2     RELEASE HOLD
C18F 7E    CD03                JMP    WARMS

                      * SUBROUTINES *
C192 C6    01         GET1     LDB    #1
C194 20    02                  BRA    GET
C196 C6    02         GET2     LDB    #2
C198 BD    CD15       GET      JSR    GETCHR      GET TWO NUMBERS AND VERIFY LIMITS
C19B 81    30                  CMPA   #$30        THEN STORE IN DATA BLOCK
C19D 2D    12                  BLT    G2ERR
C19F 81    39                  CMPA   #$39
C1A1 2E    0E                  BGT    G2ERR
C1A3 80    30                  SUBA   #$30
C1A5 A1    2B                  CMPA   11,Y        COMPARE TO LIMIT
C1A7 2E    08                  BGT    G2ERR
C1A9 A7    A0                  STA    ,Y+         THEN STORE
C1AB 5A                        DECB
C1AC 27    02                  BEQ    RTN1
C1AE 20    E8                  BRA    GET
C1B0 39               RTN1     RTS
C1B1 30    8D 00F9    G2ERR    LEAX   ERRORS,PCR
C1B5 BD    CD1E                JSR    PSTRNG
C1B8 20    DE                  BRA    GET

                      * SETUP PIA AND CHK FOR BOARD *

C1BA 4F               INIT     CLRA
C1BB B7    E011                STA    CLOCK+1
```

More

(day of week)
DATE XX:XX:XX
TIME XX:XX:XX
+ + +

When appending this to Flex, you must modify the last three bytes in the last sector of the file. These currently contain $16 CD 00, which is a loader command, and the transfer address for Flex startup. This tells the computer where to start execution of the DOS. These should be changed to $00 00 00 to remove the transfer at this point.

As you will note, the last line of the listing is END $CD00. This will restore the transfer at the new end of the file. The program currently resides at $BDB0, but the object code is location-independent, and will run anywhere without modification.

An indirect jump table is stored at the top of the utility command space; no utility uses this part of memory so it is safe here. Each clock function is available through this table. The list of possibilities is in the listing. I have used this method because changes in

the clock programs will not require each calling program to be changed, since the appropriate new address will be stored in the table. I have modified most of the programs that use a date printout so that they now also print out the time. This is very handy if you do several listings in a day and want to find the most recent one quickly. One nonstandard Flex subroutine, labeled PTEXT, is used. This routine is the same as PSTRNG except that no carriage return and line feed are issued.

Most of the required programming to read and write the clock data is supplied in these listings. There are even routines for conversion from two decimal digits to one binary digit and back.

Conclusion

This clock is an enjoyable and useful addition to my system. I no longer have to enter the date at each start-up, and I can now time operations and control things on a timed basis. The small hardware requirement and the simple software make it easy to adapt to any system.■

Listing 1 continued.

```
C1BE B7    E013              STA    CLOCK+3
C1C1 43                      COMA
C1C2 B7    E010              STA    CLOCK
C1C5 B7    E012              STA    CLOCK+2
C1C8 86    3E                LDA    #$3E
C1CA B7    E011              STA    CLOCK+1
C1CD B7    E013              STA    CLOCK+3
C1D0 F6    E012              LDB    CLOCK+2
C1D3 B1    E013              CMPA   CLOCK+3
C1D6 24    04                BCC    OK
C1D8 1A    01       NFG      ORCC   #1
C1DA 20    02                BRA    RTN
C1DC 1C    FE       OK       ANDCC  #$FE
C1DE 39             RTN      RTS

                    * SET DATA IN CLOCK/CALENDAR *

C1DF 86    80       SET      LDA    #$80
C1E1 B7    E012              STA    CLOCK+2
C1E4 8D    20                BSR    DELAY
C1E6 C6    8C       ON       LDB    #$8C
C1E8 30    8D 00F0           LEAX   BLOCK,PCR
C1EC F7    E012     DLY2     STB    CLOCK+2
C1EF A6    80                LDA    ,X+
C1F1 B7    E010              STA    CLOCK
C1F4 CA    10                ORB    #$10
C1F6 F7    E012              STB    CLOCK+2
C1F9 C4    8F                ANDB   #$8F
C1FB F7    E012              STB    CLOCK+2
C1FE C1    80                CMPB   #$80
C200 27    03                BEQ    ON3
C202 5A                      DECB
C203 20    E7                BRA    DLY2
C205 39             ON3      RTS

C206 34    02       DELAY    PSHS   A
C208 86    13                LDA    #$13
>C20A 1021 FFF8     DELAY1   LBRN   DELAY
C20E 4A                      DECA
C20F 27    02                BEQ    OVER
C211 20    F7                BRA    DELAY1
C213 35    02       OVER     PULS   A
C215 39                      RTS
```

More →

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Listing 1 continued.

```
                        * STRINGS *

C216 45 4E 54 45    INTRO    FCC    /ENTER DATE & TIME/
C21A 52 20 44 41
C21E 54 45 20 26
C222 20 54 49 4D
C226 45
C227 04                      FCB    4
C228 4E 4F 20 43    NOBD     FCC    /NO CLOCK BOARD INSTALLED/
C22C 4C 4F 43 4B
C230 20 42 4F 41
C234 52 44 20 49
C238 4E 53 54 41
C23C 4C 4C 45 44
C240 04                      FCB    4
C241 59 45 41 52    YEAR     FCC    /YEAR? 19/
C245 3F 20 31 39
C249 04                      FCB    4
C24A 4D 4F 4E 54    MONTH    FCC    /MONTH?  /
C24E 48 3F 20 20
C252 04                      FCB    4
C253 44 41 59 3F    DAY      FCC    /DAY?    /
C257 20 20 20 20
C25B 04                      FCB    4
C25C 44 41 59 53    DOW      FCC    /DAYS FROM SUNDAY?/
C260 20 46 52 4F
C264 4D 20 53 55
C268 4E 44 41 59
C26C 3F
C26D 04                      FCB    4
C26E 48 4F 55 52    HOUR     FCC    /HOUR?   /
C272 3F 20 20 20
C276 04                      FCB    4
C277 4D 49 4E 55    MINUTE   FCC    /MINUTE? /
C27B 54 45 3F 20
C27F 04                      FCB    4
C280 4C 45 41 50    LPYR     FCC    /LEAP YEAR?/
C284 20 59 45 41
C288 52 3F
C28A 04                      FCB    4
C28B 50 52 45 53    START    FCC    /PRESS ANY KEY TO START CLOCK>>>>>>/
C28F 53 20 41 4E
C293 59 20 4B 45
C297 59 20 54 4F
C29B 20 53 54 41
C29F 52 54 20 43
C2A3 4C 4F 43 4B
C2A7 3E 3E 3E 3E
C2AB 3E 3E
C2AD 04                      FCB    4
C2AE 45 52 52 4F    ERRORS   FCC    /ERROR  RE-ENTER!!!/
C2B2 52 20 20 52
C2B6 45 2D 45 4E
C2BA 54 45 52 21
C2BE 21 21
C2C0 04                      FCB    4
C2C1 57 41 4E 54    ERROR1   FCC    /WANT TO REDO FOR MISTAKES?/
C2C5 20 54 4F 20
C2C9 52 45 44 4F
C2CD 20 46 4F 52
C2D1 20 4D 49 53
C2D5 54 41 4B 45
C2D9 53 3F
C2DB 04                      FCB    4

              C2DC  BLOCK    EQU    *

C2DC                         ORG    BLOCK

C2DC                YR10     RMB    1
C2DD                YR1      RMB    1
C2DE                MO10     RMB    1
C2DF                MO1      RMB    1
C2E0                DAY10    RMB    1
C2E1                DAY1     RMB    1
C2E2                DOWK     RMB    1          DAY OF WEEK (NUMBER FROM SUNDAY)
C2E3                H10      RMB    1
C2E4                H1       RMB    1
C2E5                MI10     RMB    1
C2E6                MI1      RMB    1

C2E7 09 09 01 09    MAX      FCB    9,9,1,9,3,9,6,2,9,5,9
C2EB 03 09 06 02
C2EF 09 05 09

                             END    CALSET

SYMBOL TABLE:

BLOCK  C2DC   CALSET C100   CLOCK  E010   DAY    C253   DAY1   C2E1
DAY10  C2E0   DELAY  C206   DELAY1 C20A   DLY2   C1EC   DOW    C25C
DOWK   C2E2   ERROR1 C2C1   ERRORS C2AE   G2ERR  C1B1   GET    C198
GET1   C192   GET2   C196   GETCHR CD15   H1     C2E4   H10    C2E3
HOUR   C26E   INIT   C1BA   INTRO  C216   LPYR   C280   MAX    C2E7
MI1    C2E6   MI10   C2E5   MINUTE C277   MO1    C2DF   MO10   C2DE
MONTH  C24A   NFG    C1D8   NOBD   C228   OK     C1DC   OK2    C112
ON     C1E6   ON1    C169   ON3    C205   OVER   C213   PSTRNG CD1E
RTN    C1DE   RTN1   C1B0   SET    C1DF   START  C28B   TIME1  C103
VERSIO 0001   WARMS  CD03   YEAR   C241   YR1    C2DD   YR10   C2DC
```

Listing 2

```
                    ****************************************************
                    ****************************************************
                    ** NEW VERSION OF FLEX PATCH. ADDS NEW ROU-      **
                    ** TINES TO ALLOW ANY PROGRAM TO PRINT TIME      **
                    ** OR READ ANY CLOCK DATA. SITS AT TOP OF        **
                    ** USER AND PROTECTS ITSELF.                     **
                    ****************************************************
                    ****************************************************
                   * FLEX EQUATES *

             CC10  SYSYR   EQU    $CC10
             CC0F  SYSDAY  EQU    $CC0F
             CC0E  SYSMTH  EQU    $CC0E
             CD18  PUTCHR  EQU    $CD18
             CD1E  PSTRNG  EQU    $CD1E
             CD24  PCRLF   EQU    $CD24
             CE84  PTEXT   EQU    $CE84
             CC2B  MEMEND  EQU    $CC2B

                   * CLOCK BOARD ADDRESS FOR PORT #4 *

             E010  CLOCK   EQU    $E010
                    * CURRENT TOP OF MEMORY *

              BFFF  TOP     EQU    $BFFF      *** ADJUST FOR YOUR SYSTEM ***

                    * INDIRECT JUMP TABLE FOR CLOCK FUNCTIONS *
                    * PUT TABLE AT TOP OF UTILITY SPACE *

C6E0                        ORG    $C6E0
C6E0 BEC3           CLOCK1  FDB    DATEH      PRINT DATE WITH LABEL
C6E2 BECA           CLOCK2  FDB    DATEN      PRINT DATE AS MM/DD/YY
C6E4 BF02           CLOCK3  FDB    DATEA      PRINT DATE AS DD-MMM-YY
C6E6 BFB0           CLOCK4  FDB    DATA       BLOCK OF 13 BYTES AS CLOCK DATA
C6E8 BF66           CLOCK5  FDB    GETTIM     GET NEW TIME TO BUFFER
C6EA BF3C           CLOCK6  FDB    TIMEH      PRINT TIME WITH LABEL
C6EC BF43           CLOCK7  FDB    TIMEN      PRINT PLAIN TIME AS XX:XX:XX
C6EE BF45           CLOCK8  FDB    LSTTIM     PRINT LAST CALLED TIME PLAIN
C6F0 BE12           CLOCK9  FDB    DOW        PRINTS DAY OF WEEK
C6F2 BE6E           CLOCKA  FDB    GETDAT     GET DATA FROM STT TO STP

                    * PATCH TO JUMP TO NEW STARTUP *

CA50                        ORG    $CA50
CA50 7E    BDB0     PATCH   JMP    START1
CA53 00 00 00 00    FILL    FCB    0,0,0,0,0,0
CA57 00 00
CA59 8D    5B       RETURN  BSR    $CAB6
BDB0                        ORG    $BDB0
BDB0 CC    BDAF     START1  LDD    #START1-1
BDB3 FD    CC2B             STD    MEMEND
BDB6 4F             START2  CLRA              SETUP PIA
BDB7 B7    E011             STA    CLOCK+1
BDBA B7    E013             STA    CLOCK+3
BDBD B7    E010             STA    CLOCK
BDC0 43                     COMA
BDC1 B7    E012             STA    CLOCK+2
BDC4 86    3E               LDA    #$3E
BDC6 B7    E011             STA    CLOCK+1
BDC9 B7    E013             STA    CLOCK+3
BDCC F6    E012             LDB    CLOCK+2
BDCF B1    E013             CMPA   CLOCK+3
BDD2 27    0C               BEQ    BRDOK      BOARD OK, THEN GET DATA
BDD4 8E    CAD0             LDX    #$CAD0     ELSE USE STANDARD START
BDD7 BD    CE82             JSR    $CE82
BDDA BD    CE2C             JSR    $CE2C
BDDD 7E    CA59             JMP    $CA59
BDE0 86    A0       BRDOK   LDA    #$A0       SET UP TO GET ALL DATA
BDE2 A7    8D 01E4          STA    STT,PCR
BDE6 86    AC               LDA    #$AC
BDE8 A7    8D 01DF          STA    STP,PCR
BDEC AD    9F C6F2          JSR    [CLOCKA]   GETDATA
BDF0 17    00AD             LBSR   DT2FLX     MOVE DATE TO FLEX
BDF3 30    8D 019C          LEAX   INTRO,PCR
BDF7 BD    CD1E             JSR    PSTRNG
BDFA BD    CD24             JSR    PCRLF
BDFD AD    9F C6F0          JSR    [CLOCK9]   PRINT CURRENT DAY OF WEEK
BE01 BD    CD24             JSR    PCRLF
BE04 AD    9F C6E0          JSR    [CLOCK1]   PRINT DATE
BE08 BD    CD24             JSR    PCRLF
BE0B AD    9F C6EA          JSR    [CLOCK6]   PRINT TIME
BE0F 7E    CA71             JMP    $CA71
BE12 34    16       DOW     PSHS   A,B,X      PRINT PLAIN DAY OF WEEK
BE14 30    8D 0198          LEAX   DATA,PCR
BE18 E6    06               LDB    6,X
BE1A 86    0A               LDA    #10
BE1C 3D                     MUL
BE1D 30    8D 0007          LEAX   WKDYS,PCR
BE21 3A                     ABX
BE22 BD    CE84             JSR    PTEXT
BE25 35    16               PULS   A,B,X
BE27 39                     RTS
BE28 53 55 4E 44    WKDYS   FCC    /SUNDAY   /
BE2C 41 59 20 20
BE30 20
BE31 04                     FCB    4
BE32 4D 4F 4E 44            FCC    /MONDAY   /
BE36 41 59 20 20
BE3A 20
```

More

Listing 2 continued.

```
BE3B 04                     FCB    4
BE3C 54 55 45 53            FCC    /TUESDAY  /
BE40 44 41 59 20
BE44 20
BE45 04                     FCB    4
BE46 57 45 44 4E            FCC    /WEDNESDAY/
BE4A 45 53 44 41
BE4E 59
BE4F 04                     FCB    4
BE50 54 48 55 52            FCC    /THURSDAY /
BE54 53 44 41 59
BE58 20
BE59 04                     FCB    4
BE5A 46 52 49 44            FCC    /FRIDAY   /
BE5E 41 59 20 20
BE62 20
BE63 04                     FCB    4
BE64 53 41 54 55            FCC    /SATURDAY /
BE68 52 44 41 59
BE6C 20
BE6D 04                     FCB    4
BE6E 34   36       GETDAT   PSHS   A,B,X,Y   GET DATA FROM STT TO STP
BE70 17   0102              LBSR   HOLDIN
BE73 30   8D 0139           LEAX   DATA,PCR
BE77 31   8D 0142           LEAY   LIMIT,PCR
BE7B A6   8D 014B           LDA    STT,PCR
BE7F B7   E012     DATA1    STA    CLOCK+2
)BE82 1021 FFFC             LBRN   *
)BE86 1021 FFFC             LBRN   *
BE8A F6   E010              LDB    CLOCK
BE8D E4   A0                ANDB   0,Y+
BE8F E7   80                STB    0,X+
BE91 A1   8D 0136           CMPA   STP,PCR
BE95 27   03                BEQ    DATA2
BE97 4C                     INCA
BE98 20   E5                BRA    DATA1
BE9A 17   00ED     DATA2    LBSR   HLDOUT
BE9D 35   36                PULS   A,B,X,Y
BE9F 39                     RTS
BEA0 30   8D 0118  DT2FLX   LEAX   DATA+12,PCR MOVE DATA FROM BUFFER TO FLEX
BEA4 A6   84                LDA    0,X
BEA6 C6   0A                LDB    #10
BEA8 3D                     MUL
BEA9 EB   82                ADDB   0,-X
BEAB F7   CC10              STB    SYSYR
BEAE A6   82                LDA    0,-X
BEB0 C6   0A                LDB    #10
BEB2 3D                     MUL
BEB3 EB   82                ADDB   0,-X
BEB5 F7   CC0E              STB    SYSMTH
BEB8 A6   82                LDA    0,-X
BEBA C6   0A                LDB    #10
BEBC 3D                     MUL
BEBD EB   82                ADDB   0,-X
BEBF F7   CC0F              STB    SYSDAY
BEC2 39                     RTS
BEC3 30   8D 00DB  DATEH    LEAX   DATES,PCR PRINT DATE WITH LABEL
BEC7 BD   CE84              JSR    PTEXT
BECA 30   8D 00E2  DATEN    LEAX   DATA,PCR  PRINT PLAIN DATE
BECE A6   0A                LDA    10,X
BED0 8B   30                ADDA   #$30
BED2 BD   CD18              JSR    PUTCHR
BED5 A6   09                LDA    9,X
BED7 8B   30                ADDA   #$30
BED9 BD   CD18              JSR    PUTCHR
BEDC 86   2F                LDA    #'/
BEDE BD   CD18              JSR    PUTCHR
BEE1 A6   08                LDA    8,X
BEE3 8B   30                ADDA   #$30
BEE5 BD   CD18              JSR    PUTCHR
BEE8 A6   07                LDA    7,X
BEEA 8B   30                ADDA   #$30
BEEC BD   CD18              JSR    PUTCHR
BEEF 86   2F                LDA    #'/
BEF1 BD   CD18              JSR    PUTCHR
BEF4 A6   0C                LDA    12,X
BEF6 8B   30                ADDA   #$30
BEF8 BD   CD18              JSR    PUTCHR
BEFB A6   0B                LDA    11,X
BEFD 8B   30                ADDA   #$30
BEFF 7E   CD18              JMP    PUTCHR
BF02 10AE 8D 00A9  DATEA    LDY    DATA,PCR  PRINT ALPHA MONTH IN DATE
BF07 A6   28                LDA    8,Y
BF09 8B   30                ADDA   #$30
BF0B BD   CD18              JSR    PUTCHR
BF0E A6   27                LDA    7,Y
BF10 8B   30                ADDA   #$30
BF12 BD   CD18              JSR    PUTCHR
BF15 86   2D                LDA    #'-
BF17 BD   CD18              JSR    PUTCHR
BF1A AE   8D 00AE           LDX    MONTHS,PCR
BF1E F6   CC0E              LDB    SYSMTH
BF21 5A                     DECB
BF22 86   04                LDA    #4
BF24 3D                     MUL
BF25 3A                     ABX
BF26 BD   CE84              JSR    PTEXT
BF29 86   2D                LDA    #'-
BF2B BD   CD18              JSR    PUTCHR
BF2E A6   2C                LDA    12,Y
```

More

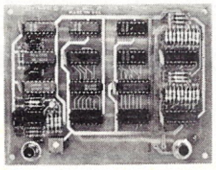
Listing 2 continued.

```
BF30 8B    30                 ADDA   #$30
BF32 BD    CD18               JSR    PUTCHR
BF35 A6    2B                 LDA    11,Y
BF37 8B    30                 ADDA   #$30
BF39 7E    CD18               JMP    PUTCHR
BF3C 30    8D 0069   TIMEH    LEAX   TIMES,PCR PRINT TIME WITH LABEL
BF40 BD    CE84               JSR    PTEXT
BF43 8D    21        TIMEN    BSR    GETTIM
BF45 30    8D 006C   LSTTIM   LEAX   DATA+5,PCR PRINT TIME IN BUFFER
BF49 C6    03                 LDB    #3
BF4B A6    84        TIME1    LDA    0,X
BF4D 8B    30                 ADDA   #$30
BF4F BD    CD18               JSR    PUTCHR
BF52 A6    82                 LDA    0,-X
BF54 8B    30                 ADDA   #$30
BF56 BD    CD18               JSR    PUTCHR
BF59 30    1F                 LEAX   -1,X
BF5B 5A                       DECB
BF5C 27    07                 BEQ    TIME2
BF5E 86    3A                 LDA    #':
BF60 BD    CD18               JSR    PUTCHR
BF63 8D    E6                 BSR    TIME1
BF65 39              TIME2    RTS
BF66 86    A0        GETTIM   LDA    #$A0
BF68 A7    8D 005E            STA    STT,PCR
BF6C 86    A5                 LDA    #$A5
BF6E A7    8D 0059            STA    STP,PCR
BF72 16    FEF9               LBRA   GETDAT
BF75 34    02        HOLDIN   PSHS   A           HOLD FOR READ
BF77 86    80                 LDA    #$80
BF79 B7    E012               STA    CLOCK+2
BF7C 86    23                 LDA    #$23
BF7E 1021  FFFC      DLY1     LBRN   DLY1
BF82 4A                       DECA
BF83 27    02                 BEQ    DLY2
BF85 20    F7                 BRA    DLY1
BF87 35    02        DLY2     PULS   A
BF89 39                       RTS
BF8A 34    02        HLDOUT   PSHS   A
BF8C 4F                       CLRA
BF8D B7    E012               STA    CLOCK+2
BF90 35    02                 PULS   A
BF92 39                       RTS
BF93 00 00 00        INTRO    FCB    0,0,0
BF96 53 49 47 4E              FCC    /SIGN ON :/
BF9A 20 4F 4E 20
BF9E 3A
BF9F 0D 0A 04                 FCB    13,10,4
BFA2 44 41 54 45     DATES    FCC    /DATE   /
BFA6 20 20
BFA8 04                       FCB    4
BFA9 54 49 4D 45     TIMES    FCC    /TIME   /
BFAD 20 20
BFAF 04                       FCB    4
BFB0                 DATA     RMB    13
BFBD 0F 0F 0F 07     LIMIT    FCB    $F,$F,$F,7,$F,3,7,$F,3,$F,3,$F,$F
BFC1 0F 03 07 0F
BFC5 03 0F 03 0F
BFC9 0F
BFCA                 STT      RMB    1
BFCB                 STP      RMB    1
BFCC 4A 41 4E        MONTHS   FCC    /JAN/
BFCF 04                       FCB    4
BFD0 46 45 42                 FCC    /FEB/
BFD3 04                       FCB    4
BFD4 4D 41 52                 FCC    /MAR/
BFD7 04                       FCB    4
BFD8 41 50 52                 FCC    /APR/
BFDB 04                       FCB    4
BFDC 4D 41 59                 FCC    /MAY/
BFDF 04                       FCB    4
BFE0 4A 55 4E                 FCC    /JUN/
BFE3 04                       FCB    4
BFE4 4A 55 4C                 FCC    /JUL/
BFE7 04                       FCB    4
BFE8 41 55 47                 FCC    /AUG/
BFEB 04                       FCB    4
BFEC 53 45 50                 FCC    /SEP/
BFEF 04                       FCB    4
BFF0 4F 43 54                 FCC    /OCT/
BFF3 04                       FCB    4
BFF4 4E 4F 56                 FCC    /NOV/
BFF7 04                       FCB    4
BFF8 44 45 43                 FCC    /DEC/
BFFB 04                       FCB    4
                              END    $CD00
SYMBOL TABLE:

BRDOK  BDE0   CLOCK  E010   CLOCK1 C6E0   CLOCK2 C6E2   CLOCK3 C6E4
CLOCK4 C6E6   CLOCK5 C6E8   CLOCK6 C6EA   CLOCK7 C6EC   CLOCK8 C6EE
CLOCK9 C6F0   CLOCKA C6F2   DATA   BFB0   DATA1  BE7F   DATA2  BE9A
DATEA  BF02   DATEH  BEC3   DATEN  BECA   DATES  BFA2   DLY1   BF7E
DLY2   BF87   DOW    BE12   DT2FLX BEA0   FILL   CA53   GETDAT BE6E
GETTIM BF66   HLDOUT BF8A   HOLDIN BF75   INTRO  BF93   LIMIT  BFBD
LSTTIM BF45   MEMEND CC2B   MONTHS BFCC   PATCH  CA50   PCRLF  CD24
PSTRNG CD1E   PTEXT  CE84   PUTCHR CD18   RETURN CA59   START1 BDB0
START2 BDB6   STP    BFCB   STT    BFCA   SYSDAY CC0F   SYSMTH CC0E
SYSYR  CC10   TIME1  BF4B   TIME2  BF65   TIMEH  BF3C   TIMEN  BF43
TIMES  BFA9   TOP    BFFF   WKDYS  BE28
```


✓See List of Advertisers on page 194

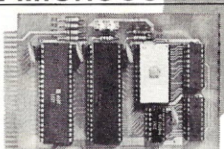
A-D & D-A CONVERTER



JBE A-D & D-A Converter can be used with any system having parallel ports • Interfaces with JBE Parallel I/O Card • D-A conversion time — 5 µs • A-D conversion time — 20 µs • Uses JBE 5V power supply • Parallel inputs & outputs include 8 data bits, strobe lines & latches • Analog inputs & outputs are medium impedance 0 to 5 volt range.

79-287 ASSM. **$79.95**
Bare Board **$39.95** Kit **$59.95**

6502 MICROCOMPUTER



This control computer has: • 1024 bytes RAM (two 2114s) • 2048 bytes EPROM (2716) • Uses one 6522 VIA (comp. doc. incl.) • Interfaces with JBE Solid State Switches & A-D & D-A Converter • Uses JBE 5V power supply • 2716 EPROM available separately (2716 can be programmed with an Apple II & JBE EPROM Programmer & Parallel Interface) • 50 pin connector included in kit & assm.

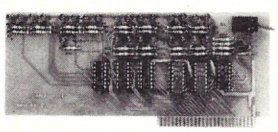
80-153 ASSM. **$110.95**
Bare Board **$49.95** Kit **$ 89.95**

SOLID STATE SWITCH

Your computer can control power to your printer, lights, stereo & any 120VAC appliances up to 720 watts (6 amps at 120VAC). Input 3 to 15VDC • 2-14MA TTL compatible • Isolation — 1500V • Non zero crossing • Comes in 1 or 4 channel version • Includes doc. for interfacing with Dimmer Control.

79-282-1 ASSM. **$13.95**
Bare Board **$6.95** Kit **$10.95**
79-282-4 ASSM. **$49.95**
Bare Board **$24.95** Kit **$39.95**

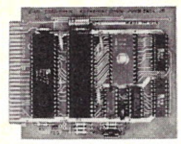
APPLE II DISPLAY BOARD



• Has run-stop, single step switch • Has 16 address LEDs, 8 data LEDs & 1 RDY LED • All lines are buffered.

80-144 ASSM. **$49.95**
Bare Board **$25.95** Kit **$42.95**

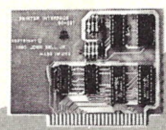
Z80 MICROCOMPUTER



JBE is announcing a single board dedicated computer designed for control functions. It features: • A Z80 Microprocessor software compatible with the Z80, 8080 & 8085 Microprocessors • Uses a Z80 PIO chip for I/O which has 2 independent 8 bit bidirectional peripheral interface ports with handshake & data transfer control • Uses one 2716 EPROM (2K) & two 2114 RAM memories (1K) • Single 5V power supply at 300MA req. • Clock frequency is 2MHz, RC controlled • Board comes with complete doc. • 50 pin connector is included • 2716 EPROM available separately.

80-280 ASSM. **$129.95**
Bare Board **$49.95** Kit **$119.95**

PRINTER INTERFACE



JBE Parallel Printer Interface interfaces your Apple II® to Centronics® compatible printers. This 3" x 4" board features: on board ROM compatible with Integer Basic, Applesoft® and Pascal® • Has one 8 bit parallel latched output port with selectable positive or negative strobe and one bit input selectable for Ready or Ready • Cable and Connectors available separately.

80-297 ASSM. **$79.95**
Kit **$69.95**
4 ft. Std. Dip Jumpers 16 pin **$ 4.25**
Champ Connector **$ 9.95**

POWER SUPPLIES

• Use wall transformers for safety • Protected against short circuit and thermal breakdown.

5 VOLT POWER SUPPLY

Rated at 5V 500MA • Operates JBE A-D & D-A Converter, Z80 & 6502 Microcomputers, 8085 & 8088 Microcomputers.

80-160 ASSM. **$20.95**
Bare Board **$8.95** Kit **$16.95**

± 12 VOLT POWER SUPPLY

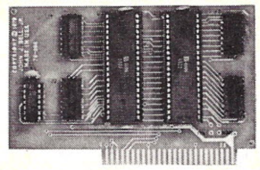
Rated at ± 12V 120MA • Can be used as a single 24V power supply • Ideally suited to OP-AMP experiments.

80-161 ASSM. **$22.95**
Bare Board **$8.95** Kit **$18.95**

ICS

6502	**$9.95**
6522	**$9.95**
Z80	**$9.95**
Z80 PIO	**$9.95**
2716 5V	**$14.95**

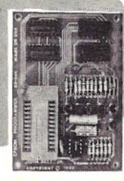
6522 APPLE II INTERFACE



• Interfaces printers, synthesizers, keyboards, JBE A-D & D-A Converter & Solid State Switches • Has handshaking logic, two 6522 VIAs & a 74LS74 for timing. Inputs & outputs are TTL compatible.

79-295 ASSM. **$69.95**
Bare Board **$39.95** Kit **$59.95**

2716 EPROM PROGRAMMER



JBE 2716 EPROM Programmer was designed to program 5V 2716 EPROMS • It can also read 2716s. It interfaces to the Apple II using JBE Parallel I/O Card & four ribbon cable connectors • An LED indicates when power is being applied to the EPROM • A textool zero insertion force socket is used for the EPROM • Comes with complete doc. for writing and reading in the Apple II or Apple II+ • Cables available separately.

80-244 ASSM. **$49.95**
Bare Board **$24.95** Kit **$39.95**

BARE BOARDS

APPLE II EXTENDER BOARD

3½" x 2½". Price includes 50 pin Apple Connector.

80-143 **$12.95**

8085 3 CHIP SYSTEM

State-of-the-art system using an 8085, 8156 & either an 8355 or 8755 • Instruction set 100% upward compatible with 8080A.

Bare Board **$24.95**

8088 5 CHIP SYSTEM

An 8086 family microcomputer system using an 8088 CPU, 8284, 8155, 8755A & an 8185.

Bare Board **$29.95**

CRT CONTROLLER

This intelligent CRT Controller is based on an 8085A Microprocessor & an 8275 Integrated CRT Controller. It features: • 25 lines, 80 characters/line • 5x7 dot matrix • Upper case only • Two 2716s • Serial Interface RS232 & TTL • Baud rates of 110, 150, 300, 600, 1200, 2400, 4800 & 9600 • Keyboard scanning system • Req's. unencoded keyboard • Uses +5V & ± 12V power supplies.

Bare Board **$39.95**

50 pin connector **$5.95**
STD. Dip Jumpers
16 Pin, 2 ft. **$4.25**

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MC

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REDWOOD CITY, CA 94064 • ADD 6% SALES TAX IN CALIFORNIA • ADD 5% SHIPPING & HANDLING
(415) 367-1137

VISA

Here's a timesaving approach to handling subscription lists.

6800 Disk-Based Mailing List

By Dr. Gordon Wolfe

As a regional officer in a nonprofit educational corporation, I frequently send out mailings to officers of local branches within the region. Also, as part of my responsibilities, I'm co-editor of a small monthly magazine. Therefore, I know how frustrating it can be to keep track of addresses, changes of address and subscription dates on paper.

A microcomputer is one way to keep yourself from going crazy. Unfortunately, most existing mailing list programs have one or two drawbacks: Either all entries are resident in memory at the same time, thus limiting the number of entries, or the program is cassette-based, thus increasing the execution time.

The solution is to store your information on disk. Execution is faster, and the size of the list is limited only by the capacity of the disk.

The program MAILST is written in Smoke Signal Broadcasting's disk file BASIC for the SWTP 6800. It requires 3K of memory in addition to the 11K BASIC interpreter, so at least 16K of memory is needed.

Hardware requirements are simple. Along with the CPU and disk you need a control terminal and a printer on port 7.

The program is self-explanatory, easy to use and tries to cover all contingencies. Also, much information on the disk may be useful in other programs.

Option List

You are first asked for the current date to be used in evaluating expired names. Then the program prints a user menu of services (Sample run 1):

1. ENTER NEW FILE—you may create a new file or mailing list.
2. ADD TO EXISTING FILE—you may add new entries to the list file.
3. PRINT MAILING TAPE—the printer puts out only names and addresses on the list file. Peel-and-stick mailing labels may be placed in the printer, since the list uses four lines to a name (Dennison's File Folder Labels, type 43-751, work perfectly in a PR-40 printer). After printing the list, the program outputs labels for all entries whose expiration date is previous to the present date, so that reminder notices may be sent for renewal. (See Sample run 2.)
4. DELETE EXPIRED NAMES—deletes any entry from the file whose expiration date is less than the current date. This is the only way to delete an entry, although it may be used in conjunction with the following option (no. 5).
5. CHANGE INFO ON FILE—prints each entry of the file on the terminal and asks if it is correct. If the answer is "no," you may change any or all of the entry by reentering the whole entry. To delete an entry entirely, simply enter zeros for the expiration date and then run option 4. (See Sample run 4.)
6. PRINT LIST—prints the complete list, with expiration dates and identifiers on the printer, with a

Dr. Gordon Wolfe, University of Mississippi, Oxford, MS 38677.

```
TODAY'S DATE (MO,YR)? 6,80


OPTION LIST

1   ENTER NEW FILE
2   ADD TO  EXISTING FILE
3   PRINT MAILING TAPE
4   DELETE EXPIRED NAMES
5   CHANGE  INFO ON FILE
6   PRINT LIST
7   LIST FILES
8   SEARCH
9   TRANSFER INFO TO OTHER FILE
0   EXIT

OPTION 7


DOS68 . 31     DFM680. 341
DFM680. 342    DFM680. 343
MAILST. BAS    DATRED. BAS
KINGDO. LST    OFFICE. LST
MAILST. KIL    REGNUM. LST
APHAR . LST    SCIENC. LST
KILOBA. LST    BOARD . LST
FRIEND. LST    DATBAS. BAS
CORPOR. LST    HAMHER. LST
```

Sample run 1.

```
OPTION LIST

1   ENTER NEW FILE
2   ADD TO  EXISTING FILE
3   PRINT MAILING TAPE
4   DELETE EXPIRED NAMES
5   CHANGE  INFO ON FILE
6   PRINT LIST
7   LIST FILES
8   SEARCH
9   TRANSFER INFO TO OTHER FILE
0   EXIT

OPTION 3


FIILE NAME (NO EXT)? KILOBA
HOW MANY COPIES? 1
DR. GORDON W. WOLFE
PHYSICS DEPT.  U.M.
UNIVERSITY  MS  38677

JAMES E. CARTER
1600 PENNSYLVANIA AVE
WASHINGTON DC   20044

WAYNE GREEN
PINE ST.
PETERBOROUGH  NH




EXPIRED SUBSCRIPTIONS



JOE KLOTZ
1234 ANYSTREET
SINGAPORE  SD   99999
EXPIRED 7209
```

Sample run 2.

Program listing.

```
*
0010 STRING= 39
0015 DIM T1(2)
0020 HOME
0025 INPUT "TODAY'S DATE (MO,YR)",M,Y
0026 LET T=100*Y+M
0030 REM
0031 REM MAILING LIST PROGRAM
0032 REM DATA ON DISK
0033 REM EXTENSION OF FILE IS
0034 REM ALWAYS .LST
0035 REM
0036 DATA .LST,TEMP.LST
0037 READ E$,D$
0039 PRINT CHR$(16);CHR$(11);CHR$(11):HO
ME
0040 PRINT "OPTION LIST":PRINT
0041 PRINT 1;TAB(5);"ENTER NEW FILE"
0042 PRINT 2;TAB(5);"ADD TO EXISTING FIL
E"
0043 PRINT 3;TAB(5);"PRINT MAILING TAPE"

0044 PRINT 4;TAB(5);"DELETE EXPIRED NAME
S"
0045 PRINT 5;TAB(5);"CHANGE INFO ON FILE
"
0046 PRINT 6;TAB(5);"PRINT LIST"
0047 PRINT 7;TAB(5);"LIST FILES"
0048 PRINT 8;TAB(5);"SEARCH"
0049 PRINT 9;TAB(5);"TRANSFER INFO TO OT
HER FILE"
0050 PRINT 0;TAB(5);"EXIT"
0051 PRINT
0060 INPUT "OPTION",O
0070 LET O=INT(O)
0071 IF O>9 THEN 60
0072 IF O<1 THEN END
0075 ON O GOTO 1000,3000,78,4000,5000,60
00,7000,8000,9000
0078 GOSUB 80
0079 GOTO 100
0080 INPUT "FILE NAME (NO EXT) ",F$
0090 LET F$=LEFT$(F$,6)+E$
0095 RETURN
0100 OPEN #1,F$
0105 INPUT "HOW MANY COPIES",Q
0106 FOR I9=1 TO Q
0110 RESTORE #1
0120 READ #1,N
0130 FOR I=1 TO N
0140 READ #1,N$,A$,C$,Z,D,I$
0145 IF D<T THEN 190
0150 PRINT #7,N$
0160 PRINT #7,A$
0170 PRINT #7,C$,
0173 IF Z<10000 THEN PRINT #7,"0";
0176 PRINT #7,Z
0180 PRINT #7
0190 NEXT I
0200 RESTORE #1
0210 SKIP #7,4
0220 PRINT #7,"EXPIRED SUBSCRIPTIONS"
0230 SKIP #7,3
0233 READ #1,N
0235 FOR I=1 TO N
0240 READ #1,N$,A$,C$,Z,D,I$
0250 IF D>T THEN 300
0260 PRINT #7,N$
0270 PRINT #7,A$
0280 PRINT #7,C$,
0283 IF Z<10000 THEN PRINT #7,"0";
0286 PRINT #7,Z
0290 PRINT #7,"EXPIRED ";D
0300 NEXT I
0305 NEXT I9
0310 CLOSE #1
0320 GOTO 39
1000 GOSUB 80
1020 OPEN #2,F$
1022 INPUT "NUMBER OF ENTRIES",N
1024 WRITE #2,N
1026 FOR I=1 TO N
1030 GOSUB 2000
1040 WRITE #2,N$,A$,C$,Z,D,I$
1050 NEXT I
1060 CLOSE #2
1070 GOTO 39
2000 INPUT "NAME",N$
2020 INPUT "ADDRESS",A$
2030 INPUT "CITY/STATE",C$
```

More

blank line between entries. (See Sample run 3.)

7. LIST FILES—lists all nonsystems (i.e., all files without a .$ extension) on the terminal. (See Sample run 1.)

8. SEARCH—searches for all entries within a file that meet the search criterion and prints all those entries. A search may be made on any category within the list, but only on one category. A search on strings looks for any string in the specified category that is identical to the search string, or for which the search string is a substring of the string in the category. Numerical searches request a range of values to search upon. (See Sample run 5.)

9. TRANSFER DATA TO OTHER FILE—searches for a specific name and, if found, will transfer the entire entry to another mailing list file, so that one name may appear in several files and need only be typed in once.

0. EXIT—returns to BASIC.

Using the Options

After you ask for each option (ex-

```
OPTION LIST

1    ENTER NEW FILE
2    ADD TO  EXISTING FILE
3    PRINT MAILING TAPE
4    DELETE EXPIRED NAMES
5    CHANGE  INFO ON FILE
6    PRINT LIST
7    LIST FILES
8    SEARCH
9    TRANSFER INFO TO OTHER FILE
0    EXIT

OPTION 6
FIILE NAME (NO EXT)? KILOBAUD
HOW MANY COPIES? 1
OUTPUT ON SCREEN OR PRINTER?
P


GENIUS
DR. GORDON W. WOLFE
PHYSICS DEPT. U.M.
UNIVERSITY  MS  38677
8008

PRESIDENT
JAMES E. CARTER
1600 PENNSYLVANIA AVE
WASHINGTON DC   20044
8101

PUBLISHER/MICROCOMPUTING
WAYNE GREEN
PINE ST.
PETERBOROUGH  NH              03458
9010

ESCAPEE FROM THE HOME
JOE KLOTZ
1234 ANYSTREET
SINGAPORE  SD   99999
7209
```

Sample run 3.

cept for options 0 and 7), the program will request the name of the source file (with no extension). The program will truncate the string to the first six characters and add the extension .LST. In this way, you can keep many lists on a disk.

Also notice that this makes it easier to remember filenames. In Sample run 3, the file used is KILOBA.LST; I enter KILOBAUD, meaning this is a demonstration for this article in *Kilobaud*, and the program uses only the first six letters.

Sample run 1 shows the format of the option list and the execution of the list files option. Notice that the listing includes *all* nonsystem files (files without a .$ extension) resident on the disk, including the disk operating system, disk file management, mailing list routine, files for other programs and the .LST files.

Sample run 3 shows the execution of option 6, which lists the contents of the file. I specify the filename (no extension), tell it I only want one copy (but I may print as many as I wish) and have it place the results on the terminal rather than the PR-40 print-

```
OPTION LIST

1   ENTER NEW FILE
2   ADD TO  EXISTING FILE
3   PRINT MAILING TAPE
4   DELETE EXPIRED NAMES
5   CHANGE  INFO ON FILE
6   PRINT LIST
7   LIST FILES
8   SEARCH
9   TRANSFER INFO TO OTHER FILE
0   EXIT

OPTION 5
FIILE NAME (NO EXT)? KILOBA

GENIUS
DR. GORDON W. WOLFE
PHYSICS DEPT. U. M.
UNIVERSITY  MS  38677
8008

ANY CHANGES (Y OR N)? Y
NAME? GORDON WOLFE
ADDRESS? PHYSICS DEPT U. M.
CITY/STATE? UNIVERSITY  MS
ZIP? 38677
IDENTIFIER? SUPERGENIUS
EXPIRES (MO, YR)? 99 ,99

PRESIDENT
JAMES E. CARTER
1600 PENNSYLVANIA AVE
WASHINGTON DC   20044
8101

ANY CHANGES (Y OR N)? N

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PETERBOROUGH  NH                  03458
9010

ANY CHANGES (Y OR N)? N
```

Sample run 4.

Listing continued.

```
2040 INPUT "ZIP",Z
2050 INPUT "EXPIRES (MO,YR)",M1,Y1
2051 INPUT "IDENTIFIER",I$
2055 LET D=100*Y1+M1
2060 RETURN
3000 GOSUB 80
3010 OPEN #1,F$
3020 OPEN #2,D$
3030 READ #1,N
3040 INPUT "NUMBER OF NEW ENTRIES",N1
3050 LET N=N+N1
3060 WRITE #2,N
3070 FOR I=1 TO N-N1
3080 READ #1,N$,A$,C$,Z,D,I$
3090 WRITE #2,N$,A$,C$,Z,D,I$
3100 NEXT I
3110 FOR I=1 TO N1
3120 GOSUB 2000
3130 WRITE #2,N$,A$,C$,Z,D,I$
3140 NEXT I
3150 CLOSE #2
3155 CLOSE #1
3160 FDEL F$
3170 FREN D$,F$
3180 GOTO 39
4000 GOSUB 80
4020 OPEN #1,F$
4030 READ #1,N
4040 FOR I=1 TO N
4050 READ #1,N$,A$,C$,Z,D,I$
4060 IF D<T THEN N=N-1
4070 NEXT I
4080 OPEN #2,D$
4090 WRITE #2,N
4100 IF N=0 THEN 4300
4110 RESTORE #1
4120 READ #1,N1
4125 FOR I=1 TO N1
4130 READ #1,N$,A$,C$,Z,D,I$
4140 IF D<T THEN 4200
4150 WRITE #2,N$,A$,C$,Z,D,I$
4200 NEXT I
4300 CLOSE #1
4310 CLOSE #2
4320 FDEL F$
4330 FREN D$,F$
4340 GOTO 39
5000 GOSUB 80
5020 OPEN #1,F$
5025 OPEN #2,D$
5030 READ #1,N
5035 WRITE #2,N
5040 FOR I=1 TO N
5050 READ #1,N$,A$,C$,Z,D,I$
5060 HOME
5065 LET N2=1
5070 GOSUB 6050
5120 PRINT
5130 INPUT "ANY CHANGES? (Y OR N)",Y$
5140 LET Y$=LEFT$(Y$,1)
5150 IF Y$="Y" THEN 5170
5160 IF Y$<>"N" THEN 5130
5165 GOTO 5300
5170 GOSUB 2000
5300 WRITE #2,N$,A$,C$,Z,D,I$
5310 NEXT I
5320 GOTO 4300
6000 GOSUB 80
6001 INPUT "HOW MANY COPIES",X
6002 GOSUB 9300
6005 FOR Y=1 TO X
6010 OPEN #1,F$
6020 READ #1,N
6030 FOR I=1 TO N
6040 READ #1,N$,A$,C$,Z,D,I$
6044 GOSUB 6050
6046 GOTO 6110
6050 PRINT #N2
6060 PRINT #N2,I$
6070 PRINT #N2,N$
6080 PRINT #N2,A$
6090 PRINT #N2,C$,
6093 IF Z<10000 THEN PRINT #N2,"0";
6096 PRINT #N2,Z
6100 PRINT #N2,D
6105 RETURN
6110 NEXT I
6120 CLOSE #1
6124 PRINT :PRINT
6125 NEXT Y
```

More →

er. The program reads the disk file and prints:

Identifier
Name
Address
City/state and zip
Expiration date
Blank line

for each entry in the file.

This could be used by itself as a mailing list. But option 3 will do the same without the identifier or the expiration date and will do it only on the PR-40 printer, so I can use peel-and-stick mailing labels (Sample run 2). Notice that only current subscriptions are printed, with an expiration list for renewal notices. In particular, notice that three subscribers will get their mailing, while Joe Klootz, who hasn't renewed his subscription, will get a reminder postcard. After printing, option 4 will delete his name.

Sample run 4 shows how changes are made. Option 5 is executed on the file KILOBA. In this case, I want to change the identifier on my name from "genius" to "supergenius." The program reads each entry from the disk and displays it and then asks for changes. If there are none, it reads and displays the next entry. If changes are to be made, the entire entry is reentered with corrections.

Sample run 5 demonstrates the search option. Option 8 is executed, and again the KILOBA file is specified.

At this point, the program asks what category to search. Suppose I wish to send letters to all presidents on the list (maybe I have a list of world leaders or a list of officers of local chapters within the state). "President" is an identifier, so I select option 7.

After specifying that I want the results on the terminal, I input the string "PRES" to search. The program will read the entire file, and anytime the substring "PRES" is found in an identifier string, the entry will be printed as shown. When the end of the file is reached, the program tells me, so I'll know it's done even if it hasn't found anything.

Also, note that it would have printed the entry if it had found an identifier "AXPLPRESYZT," since it contains "PRES."

No commas are allowed during string input. BASIC will truncate any string just before the comma, since it assumes you're ending one string and beginning another. This means that the usual method of entering city and

Listing continued.

```
6130 GOTO 39
7000 HOME
7010 FLIST
7030 WAIT 5
7034 GOTO 39
8000 REM SEARCH
8010 GOSUB 80
8020 OPEN #1, F$
8030 READ #1, N
8040 HOME :PRINT "SEARCH ON"
8050 PRINT 1; "NAME"
8051 PRINT 2; "ADDRESS"
8053 PRINT 3; "CITY"
8054 PRINT 4; "STATE"
8055 PRINT 5; "ZIP CODE"
8056 PRINT 6; "EXPIRATION DATE"
8057 PRINT 7; "IDENTIFIER"
8059 PRINT 8; "EXIT"
8060 INPUT "OPTION", O1
8070 LET O1=INT(O1)
8080 IF O1<1 THEN8040
8090 IF O1>=8 THEN 39
8095 GOSUB 9300
8100 ON O1 GOTO 8170, 8290, 8370, 8870, 8530
, 8550, 8450
8110 INPUT "SEARCH STRING", S$
8120 LET L=LEN(S$)
8130 RETURN
8140 INPUT "MAXIMUM VALUE", M2
8150 INPUT "MINIMUM VALUE", M1
8160 RETURN
8170 GOSUB 8110
8175 FOR I=1 TO N
8180 GOSUB 8905
8190 LET T$=N$
8200 GOSUB 8920
8210 IF M3=1 THEN GOSUB 8250
8220 NEXT I
8230 PRINT "END OF FILE ";F$
8240 GOTO 8270
8250 GOSUB 6050
8265 RETURN
8270 CLOSE #1
8280 GOTO 39
8290 GOSUB 8110
8300 FOR I=1 TO N
8310 GOSUB 8905
8320 LET T$=A$
8330 GOSUB 8920
8340 IF M3=1 THEN GOSUB 8250
8350 NEXT I
8360 GOTO 8230
8370 GOSUB 8110
8380 FOR I=1 TO N
8390 GOSUB 8905
8400 LET T$=C$
8410 GOSUB 8920
8420 IF M3=1 THEN GOSUB 8250
8430 NEXT I
8440 GOTO 8230
8450 GOSUB 8110
8460 FOR I=1 TO N
8470 GOSUB 8905
8480 LET T$=I$
8490 GOSUB 8920
8500 IF M3=1 THEN GOSUB 8250
8510 NEXT I
8520 GOTO 8230
8530 LET T=1
8540 GOTO 8560
8550 LET T=2
8560 GOSUB 8140
8570 FOR I=1 TO N
8580 GOSUB 8905
8590 IF T1(T)>M2 THEN 8710
8600 IF T1(T)<M1 THEN 8710
8650 LET N2=7
8700 GOSUB 6050
8710 REM NO MATCH
8720 NEXT I
8730 GOTO 8230
8870 GOSUB 8110
8880 LET S$=" "+S$
8890 GOTO 8380
8900 REM READ DATA FROM FILE
8905 READ #1, N$, A$, C$, T1(1), T1(2), I$
8910 LET Z=T1(1):D=T1(2)
8915 RETURN
8920 REM COMPARE STRINGS
8925 LET L2=LEN(T$)
```

More →

Listing continued.

```
8920 LET M3=0
8930 IF L2<L THEN 8990
8935 FOR J=1 TO L2-L+1
8940 IF S$<>MID$(T$,J,J+L-1) THEN 8980
8950 REM MATCH
8960 LET M3=1
8970 GOTO 8990
8980 NEXT J
8990 RETURN
9000 HOME
9010 PRINT "SOURCE"
9020 GOSUB 80
9030 OPEN #1,F$
9040 PRINT "DESTINATION"
9050 GOSUB 80
9060 OPEN #2,F$
9070 OPEN #3,D$
9075 INPUT "NUMBER OF ITEMS TO TRANSFER"
,I1
9080 READ #2,N
9090 WRITE #3,N+I1
9095 FOR J=1 TO I1
9100 READ #1,M1
9105 INPUT "NAME TO TRANSFER",S$
9110 FOR I=1 TO M1
9120 GOSUB 8905
9130 IF N$<>S$ THEN 9160
9140 WRITE #3,N$,A$,C$,Z,D,I$
9150 GOTO 9170
9160 NEXT I
9170 RESTORE #1
9180 NEXT J
9190 CLOSE #1
9200 FOR I=1 TO N
9210 READ #2,N$,A$,C$,Z,D,I$
9220 WRITE #3,N$,A$,C$,Z,D,I$
9230 NEXT I
9240 CLOSE #2,#3
9250 FDEL F$
9260 FREN D$,F$
9270 GOTO 39
9300 PRINT "OUTPUT ON SCREEN OR PRINTER?
"
9305 LET N2=0
9310 INPUT Y$
9320 LET Y$=LEFT$(Y$,1)
9330 IF Y$="S" THEN N2=1
9340 IF Y$="P" THEN N2=7
9350 IF N2=0 THEN 9300
9360 RETURN
```

```
OPTION LIST

1  ENTER NEW FILE
2  ADD TO  EXISTING FILE
3  PRINT MAILING TAPE
4  DELETE EXPIRED NAMES
5  CHANGE  INFO ON FILE
6  PRINT LIST
7  LIST FILES
8  SEARCH
9  TRANSFER INFO TO OTHER FILE
0  EXIT

OPTION 8
FIILE NAME (NO EXT)? KILOBA

SEARCH ON
1 NAME
2 ADDRESS
3 CITY
4 STATE
5 ZIP CODE
6 EXPIRATION DATE
7 IDENTIFIER
8 EXIT
OPTION? 1
OUTPUT ON SCREEN OR PRINTER?
P
SEARCH STRING? CARTER


PRESIDENT
JAMES E. CARTER
1600 PENNSYLVANIA AVE
WASHINGTON DC   20044
8101
```

Sample run 5.

state—"Baltimore, MD"—will not work because ", MD" will be cut off. The program has been structured to use a space instead of a comma (i.e., "Baltimore MD").

City and state are in the same string. A search on the state assumes that there is a space just before the state. You need not enter this space when requested to do so for the search string, but it must be there on the file, so you must enter it when you originally enter the data.

An identifier entry is also included with the name and address information. This is a string variable, which may be anything at all. In keeping a mailing list of officers for my nonprofit group, I simply write the position, a slash and the name of the local branch. Keeping track of who's doing what is much easier.

For lists that do not deal with subscriptions and where a name does not expire at a fixed time, enter "99" for the month and year of expiration.

All information is stored in string format, except for zip codes and expiration dates, which are stored as numeric variables so that a sorting routine may be written to print a mailing tape in zip-code order to take advantage of the post office's reduced rates for pre-sorted mail.■

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Simulate planetary motion in the solar system using high-resolution graphics on the Apple II.

Electronic Orrery

By Fred J. Gunther

Have you ever visited a planetarium? Or perhaps taken a class in astronomy? If so, you have probably encountered an orrery—a mechanical model of the solar system.

An orrery usually consists of a box containing many interconnected gears. A number of smaller spheres, representing the planets, are connected to the gears so that they revolve around a central sphere, the Sun. The orrery shows the sequence, orbits and motions of the planets and some of the moons.

Driven by clockwork and controlled by the gears, these models have been built by clock instrument makers since the Middle Ages. This program lets you use your Apple II to bring modern technology to this traditional craft. Using Applesoft BASIC and high-resolution graphics, it will turn your Apple into a simple orrery.

The program in its present form could be used for a beginning course in earth science or astronomy. Or it could be used as a basis for a space wars game. The orrery can be as complex as you would like it.

The Program

I've made several adjustments to reduce the programming problems. First, the planetary orbits are circles rather than ellipses. (With the scales provided, though, you can't tell the difference.) Second, each planet, no matter how big or small, is represented by a single dot. (Again, this is a matter of scale.) And third, the program does not plot any moons, since they're too close to their primaries to show up on an orrery done to scale.

The program gives you a choice of scales. Different scales are needed to show details in the orbit and positions of the inner versus the outer planets. You can much better appreciate the size of the solar system

```
5  TEXT : HOME : CLEAR
10  DIM OP(9),PY(9),I(9)
50  GOTO 300
80  HOME : VTAB 21
90  PRINT "        A P P L E     O R R E R Y
100  REM   PLOT CIRCULAR ORBITS
105  REM  OFFSET PLUTO'S ORBIT TO SIMULATE ELLIPSE.
110  INVERSE : PRINT "DAY                          YEAR  (EARTH)          ": NORMAL
115  HGR : HCOLOR= 7: POKE 34,22
120  LET W = (1 * PI) / 180
130  FOR J = 1 TO 9: LET R = OP(J) / SCALE
135  LET I(J) = I(J) + (PY(3) / PY(J) * TD)
140  LET Y = Z * I(J)
150  LET X = XC + R *  COS (W + Y)
160  LET Y = YC - R *  SIN (W + Y)
165  IF J = 9 THEN  LET X = X + (1500E06 / SCALE)
170  IF X > 279 OR X < 0 THEN  GOTO 190
175  IF Y > 159 OR Y < 0 THEN  GOTO 190
180  HPLOT X,Y
190  NEXT J: IF RBIT = 1 THEN  GOTO 200
195  CALL 62450
200  HPLOT XC - 1,YC TO XC + 1,YC
210  HPLOT XC,YC - 1 TO XC,YC + 1
215  PRINT I(3),I(3) / PY(3)
220  GOTO 130
300  REM  SET UP SOLAR SYSTEM
500  REM   OP(I) = DIAMETER OF PLANETARY ORBIT
505  REM  PY(I) = PLANETARY YEAR.
510  LET OP(1) = 57.9E06: LET PY(1) = 87.97
520  LET OP(2) = 108.2E06: LET PY(2) = 224.7
530  LET OP(3) = 149.6E06: LET PY(3) = 365.26
540  LET OP(4) = 227.9E06: LET PY(4) = 686.98
550  LET OP(5) = 778.3E06: LET PY(5) = 11.86 * PY(3)
560  LET OP(6) = 1427E06: LET PY(6) = 29.46 * PY(3)
570  LET OP(7) = 2869.6E06: LET PY(7) = 84.01 * PY(3)
580  LET OP(8) = 4496.6E06: LET PY(8) = 164.79 * PY(3)
590  LET OP(9) = 5.9E09: LET PY(9) = 248.4 * PY(3)
600  LET PI = 3.14159: LET P2 = PI * 2
650  FOR J = 0 TO 9:I(J) = 0: NEXT J
700  LET Z = P2 / 360
800  INPUT "SCALE = (5E5 -1E8) ";SCALE
820  PRINT "PLOT ORBITAL PATH (TYPE '1') OR"
825  PRINT : INPUT "PLANET POSITION ONLY (TYPE '0') ";RBIT
850  INPUT "SUN LOCATION (X,1-278; Y,1-158)? ";XC,YC
875  INPUT "TIME INCREMENT(DAYS) ";TD
1000  GOTO 80: END
```

Program listing.

Fred J. Gunther (9464 Wandering Way, Columbia, MD 21045) is a geologist who has been using computers in research and teaching for about 14 years.

when, at any scale that includes Pluto, the display shows the inner planets practically merged with the Sun. On the other hand, any scale that shows orbital details for the inner planets has all of the outer planets (except perhaps Jupiter) off the screen.

The program prompts for the scale factor when the run starts. Then it prompts you for the location of the Sun. The Sun must be on the display screen (between 1 and 158 vertically and 1 and 278 horizontally), but it does not have to be in the center of the display. It is OK for a planet to be beyond the screen boundary; in fact, that's where the outermost planets usually are.

The program always starts with the planets in a standard starting position. As it runs, each planet progresses around the Sun in its own orbit at its own rate. The progression is discontinuous rather than continuous; that is, the new position is shown for the planet after the passage of a certain amount of time (you are prompted to provide the time increment), usually one Earth day. The program also gives you the option of showing only the instantaneous location of each planet, or of showing all of the points that make up the orbital paths. In either case, a short time interval is appropriate for the inner planets and a long one for the outer planets.

Let's talk about "scale" for a moment. The scale factor requested at the start of the program run is divided into the distance from the Sun to the planet. This yields the orbital radius in screen units. For example, the distance from the Earth to the Sun is an average of 149.6×10^6 km (93×10^6 mi.). If you type in a scale factor of "1E6" (1.0×10^6), then the Earth-Sun radius will be represented by 150 screen units. This distance, one astronomical unit (1 AU), is a standard yardstick for measurement within and near the solar system.

```
 RUN
SCALE = (5E5 -1E8) 1E7
PLOT ORBITAL PATH (TYPE '1') OR

PLANET POSITION ONLY (TYPE '0') 0
SUN LOCATION (X,1-278; Y,1-158)? 100,80
TIME INCREMENT(DAYS) 5
       A P P L E    O R R E R Y
DAY                YEAR  (EARTH)
5                .0136888792
10               .0273777583
15               .0410666375
20               .0547555166
25               .0684443958
30               .0821332749
35               .0958221541
40               .109511033
45               .123199912
50               .136888792
```

Input sequence and partial run.

Modifications

Experienced programmers will find certain modifications challenging. Try adding the Earth's moon. Try adding at least the Galilean moons to Jupiter. Add, if you can, the O'Neill space colonies at the Legrangian points for the Earth-Moon system. Add the Trojan asteroids (this is an easy one).

Try to add a few comets (start with a nice periodic one like Halley's Comet, but remember that it moves around the Sun in a direction opposite that of the planets). The comets must have elliptical orbits (Kepler's First Law of Planetary Motion) and obey the "equal areas in equal time" law (Kepler's Second Law).

Try making the orbit of Mercury properly elliptical and with the proper precession of its "aphelion" (closest approach to the Sun).

Not all added features can be appreciated at one scale, so add a scale-change feature, perhaps under the control of the game paddles. Add a window feature, perhaps under the control of a joystick, so that you can look at different portions of the solar system. (Hint—move the Sun relative to the screen.)

If you have added both a scale-change feature and a window feature, then add all of the moons, give each planet and large moon a disk rather than a point, and get ready for a grand tour of the solar system.■

Suggested Readings

Weaver, Kenneth F. "Voyage to the Planets." *National Geographic*, volume 138, number 2 (August 1970), pp. 147–193.

Henderson, Arthur, Jr., and Jerry Grey. *Exploration of the Solar System.* National Aeronautics and Space Administration EP-122. U.S. Government Printing Office, 1974. Washington, DC, 67 pp. $2.05.

"The Solar System." *Scientific American* (September 1975), 280 pp. Special issue.

Pournelle, J. E. "The Endless Frontier." In *The Endless Frontier*, Ace Books, 1974, pp. 3–24.

✓See List of Advertisers on page 194

Here's an in-depth look at a word processor that has become the de facto standard for microcomputers.

Word Processor Extraordinaire

By Glenn A. Hart

WordStar is an integrated word-processing program for CP/M and derivative operating systems. Sold by MicroPro International Corporation (1299 Fourth Street, Suite 400, San Rafael, CA 94901), WordStar is a powerful and complex program which provides a high level of operating flexibility and has become almost a standard against which all microcomputer word processors are judged. After several generations of development, the newest version (2.26) contains even more features.

Installation

WordStar is unique in its ability to accommodate various operating environments. The distribution disk contains four files: a message file used to print the many prompts and messages to the user, an "uninstalled" WordStar system, an associated overlay file and an Install utility. After making safety backup copies, the user runs Install to customize Wordstar to his equipment configuration.

The various serial terminals and memory-mapped video boards which WordStar can support are listed in Table 1. Almost all major types are available, and instructions are also given to the technically adept to patch in nonstandard terminal drivers other than these. WordStar takes advantage of the special characteristics of most terminals, using reverse video, dual intensity, cursor addressing and clear screen, if available.

Two main classes of printers are supported: daisywheel and other similar printers and "Teletype-like" standard printers (which means practically any printer usable with a microcomputer). Specialty printers from Diablo, Qume and NEC are supported with special drivers, as indicated in Table 2, and WordStar will print bidirectionally with such printers, using a microspace justification algorithm which uses both added spacing between words and character spreading.

A memory location can be patched to change the spreading emphasis to less character spacing and more interword spacing if desired. Standard printers are further subdivided into those that can backspace or half linefeed in either direction, and WordStar will change the way it prints boldface, underscores and other special printing tasks to accommodate the printer's abilities.

If required by his printer, the user has a choice of communications protocols. The standard Diablo ETX/ACK is normally used, but the newer XON/XOFF (DC3/DC1) protocol is also supported, as is hardware handshaking or other protocols resident in the user's BIOS.

WordStar can communicate to the printer in different methods: Output can be sent to the standard CP/M LST: device, which would be the most normal setup; to secondary CP/M devices such as TTY: or CRT:; or directly through output ports unique to the user's hardware. Completely customized output drivers can also be added.

Unlike earlier versions, the newest WordStar is not set up for Imsai port configurations; the user must supply the hex address of his input and output data and control ports. WordStar will then determine the correct bits to use automatically. Direct output to the ports provides faster printer speed and results in better overall performance.

MicroPro is the only word processor supplier which provides the code necessary to customize the system to different terminals and printers. Other programs require that the hardware configuration be specified at the time the program is purchased, and the program then supplied will work only on that configuration. MicroPro's method allows the user with different printers to create special versions; I use two versions called WS1650 and WS1760 with my two very different printer terminals—a Diablo 1650 metal daisywheel terminal and a Xerox 1760 high-speed matrix terminal.

While the installation procedure is very well done and the documentation provided is excellent, novice users may have to do some digging in their manuals to decide what options to use. Of course, their dealers can configure the system in advance.

Start-Up

WordStar begins with a heading showing the equipment configuration which has been patched to the program. This and all other menus and prompts are shown in reverse video or highlighted areas if the terminal system supports such features. After a brief pause, the basic menu is displayed, with the program reminding you that "no file is now being edited." The choices available are shown in Table 3.

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Lear-Siegler ADM-3A	Soroc IQ-120
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Microterm ACT-IV	Visual 200
Microterm ACT-V	Flashwriter I
Beehive 150/Cromemco 3100	Flashwriter II
Imsai VIO	SWTPC CT-82
Hewlett-Packard 2621 A/P	Compucolor 8001G
Infoton I-100	TEC Model 571
Processor Tech Sol/VDM	

Table 1. Terminals supported by version 2.26.

```
A   Any "Teletype-like" printer (i.e almost any printer)
C   "Teletype-like" printer that can BACKSPACE
D   DIABLO 1610/1620 daisy wheel printer
E   DIABLO 1640/1650 daisy wheel printer
F   QUME Sprint 5 daisy wheel printer
G   NEC Spin Writer 5510/5520 thimble printer
I   "Half-Line-Feed" Printers
U   No change
Z   None of the above

PLEASE ENTER SELECTION (1 LETTER):
```

Table 2. Printer menu.

```
        no file is now being edited

D=create or edit a Document file          H=set Help level
N=create or edit a Non-document file      X=eXit to system
M=Merge-print a file                      P=Print a file
F=File directory off (ON)                 Y=delete a file
L=Change Logged disk                      O=cOpy a file
R=Run a program                           E=rEname a file

DIRECTORY of disk A:
WORDSTAR.REV WS1650.COM     WS1760.COM    WSMSGS.COM
```

Table 3. "No-file" menu.

The difference between a "document" and a "non-document" is that documents are preformatted by WordStar and stored on disk that way (more about this later). Defaults for word-wrap, tabulation, justification and other parameters are also different, with the non-document mode used for assembly-language programs, high-level programs or any file which will be accessed by some other program. This distinction is necessary since WordStar inserts many control codes in a document file to control on-screen formatting, and these control codes make a document file incompatible with other programs.

WordStar has various levels of user prompting and assistance shown on the screen throughout the editing and printing process. These prompts explain almost all the commands available to the user and are necessary to make the system usable without an unacceptable amount of memorization or frequent references to the manual.

After a while, most of the common functions become familiar and the screen space taken up by the prompting menus can be better used to display more text. WordStar gives the user the ability to change the amount of prompting displayed to one of four "help levels."

Previously edited and formatted files can be printed without entering the editing process. You are asked for the name of the file to print, followed by either an escape or return. If an escape is entered, printing begins with certain default conditions. If a return is entered, you are asked whether disk file output is desired (to print a formatted file to disk for later viewing or further processing), what page to start and stop printing on, whether to pause for the paper to be changed after each page (for use with single sheets rather than continuous forms) and whether to use form feeds or line feeds to advance to the top of subsequent pages. Printing proceeds once these conditions are specified. Files can also be printed with an optional utility called Mail-Merge, which performs many other options and will be discussed later.

This "no-file" menu also performs many "operating system" type functions like deleting files, renaming files and copying files. Version 2.26 also allows running an unrelated program from WordStar with control returning to WordStar after completion of the run program. This is convenient if you use WordStar to prepare compiler programs. The compiler can be called from WordStar, and when errors are encountered WordStar will be automatically loaded to make the necessary corrections. Another use is to load one of the new spelling-correction programs from WordStar so the editor will be entered after the spelling errors are isolated.

Version 2.26 includes provisions for displaying a directory of files on the default disk (which can also be changed with a new "logged-disk" feature). The directory can be displayed during the "no-file" menu or while editing is in progress. The lack of such a directory feature was a major inconvenience in earlier versions of WordStar. Incidentally, Micro-Pro will upgrade earlier versions for a $25 copying charge and will supply the relevant new manual pages for $15.

Once the user indicates he wants to edit a file, the program prompts with a complete explanation of CP/M filenaming conventions and asks for the desired filename. No default extensions are provided, and the user is free to use whatever extension designations he wants (or none at all). WordStar either indicates that the file is new or reads in a portion of a preexisting file and displays the first menu and the initial screen of text. The handling of files too large to fit completely in memory is transparent to the user, with WordStar performing all disk reads and writes automatically.

Operation

The top screen line is a status line which always appears, even if the help level chosen inhibits some or all of the normal prompting. The status line indicates the current operating status and definitions in use, including the name of the file being edited; the page, line and column number for documents (lines and bytes from the beginning of the file for non-documents); INSERT ON, WAIT (usually during disk accesses); MAR REL

```
        PAGE 1  LINE 1  COL 1
CURSOR:    ^A=left word        ^S=left char       ^D=right char       ^F=right word
           ^E=up line          ^X=down line
SCROLL:    ^Z=up line          ^W=down line       ^C=up screen        ^R=down screen
DELETE:   DEL=char left        ^G=char right      ^T=word right       ^Y=entire line
OTHER:   ^V=insert on/off      ^X=tab            RETURN=end para      ^U=stop
       ^N=insert a RETURN      ^B=reform to end para        ^L=find/replace again
HELP: ^J displays menu of information commands
PREFIX KEYS    ^Q ^J ^K ^O ^P display menus of additional commands
L----!----!----!----!----!----!----!----!----!----!--------R
```

Table 4. Basic menu.

(margin release); LINE SPACING n (if more than single-spaced lines); and PRINT PAUSED (for insertion of single sheets). The status line is invaluable in determining what is going on and is displayed like a message, in highlighted or reverse video if available.

Under the status line is a "ruler line," which shows tab settings and the position of the left and right margins. This line can be disabled if desired, and tab settings can be changed at will. When menus are displayed, they displace the text which was under them, but everything returns to normal after the menu is removed. Note that all commands can be entered in either upper or lowercase.

Perhaps the best way to examine all the functions available in WordStar is to review the prompting menus and explain the various operations shown on each.

The Basic Menu

The basic menu (see Table 4) covers all the commands which can be entered with a single control character (indicated by ↑). The screen cursor can be moved in any direction a character at a time or a "word" at a time. Word boundaries do not include punctuation. The ability to move by words is unusual, and speeds cursor movement dramatically. The cursor will only move to areas which contain text, so moving down a line will often move the cursor to the left edge of the screen. The layout of the control codes chosen is very logical, with the functions of the codes suggested by the relationship of the keys on the keyboard. The cursor can also be moved in several other ways by more complicated commands.

Scrolling can be done in both directions either a line at a time or by chunks representing a little less than one full screen of text. This provides a useful overlap so each screen of information contains a bit of the preceding screen for continuity.

Simple deletions in either direction by character or word are possible. Entire lines or segments of lines in either direction can be deleted. Some of these commands are specified on the next menu.

Insert mode is toggled on or off with ↑V, and the status line indicates whether insertion is on or off. ↑N inserts a return, providing an empty line in the file for spacing or upon which to enter text. ↑U interrupts a command in progress, and ↑L repeats a search or find (more about searching later).

The ↑B command is a hint of what is probably WordStar's most dramatic and useful feature. As with many other word processors, text is entered continuously with no need for the typist to enter carriage returns at the end of screen lines. Words are automatically moved down to the next line (hyphenated words may be split at the hyphen) if they won't fit on the current line. But when WordStar completes filling a line of text, *each screen line is automatically formatted and justified just as it will appear in the final printed copy!*

The implications of this are tremendous. Not only can the typist see how each line will look and change words or spacing if desired, but the program can also keep track of how each page will look. WordStar displays an end of page indicator (a complete line of dashes followed by P) exactly where each page break will occur. This is invaluable in many respects. Widow paragraphs (only one or two lines at the end or beginning of a page) are easily avoided without conditional statements prefacing each paragraph. Multiple line headings can be typed in at the top of each page. Many other uses are possible as well.

The ↑B command also invokes another unique WordStar feature: hyphenation help. If a line is likely to look bad when printed due to the presence of a long word, the program will suggest that the word be hyphenated and will even recommend where to place the hyphen. The operator has the option of accepting the program's suggested location, moving the hyphen to another spot in the word or rejecting hyphenation entirely. Hyphenation help can be disabled if desired.

WordStar is the only word processor to incorporate these features. Now the meaning of the ↑B command can be understood: the ↑B command reformats each paragraph after insertions and/or deletions or when a completely different layout is desired. An entire document can be reformatted with a repeat command described later.

There are a few problems with this feature. Certain commands which set up formatting must be entered carefully and at the beginning of the document if pagination is to be accurate. Reformatting long paragraphs can take a few seconds, and even longer for a long document. Also, the formatting adds a lot of special control characters to the file to distinguish between spaces entered by the typist (which are always retained) and "soft" spaces inserted by the program for justification. This makes formatted text files much longer than normal files or the files produced by other word processors. All in all, however, the on-screen formatting and pagination are fantastic.

The basic menu continues with ↑J, the help command. When this command is invoked, a special menu appears which has helpful paragraphs explaining most functions or the meaning of special on-screen end of line indicators. This is useful for making sure of the correct usage of infrequently used commands, and is also a tremendous help in using the program without constant reference to the excellent but lengthy documentation.

The final menu entry indicates the "prefix keys," which allow use of the remainder of WordStar's commands as well as examining the various other menus. Entering just these control characters brings up the other menus, which then allow either the desired command to be entered and executed or a return to normal editing with the cursor returned to its previous position.

Note that other than the normal commands shown on the basic menu, all WordStar commands involve two or even three control or regular characters. Fortunately, the control key can be held down continuously while

the sequence of letters is entered, and quickly entering the characters inhibits display of the menu involved. This speeds things up quite a bit, but there is no question that a lot of control characters have to be typed. This is the price that must be paid for the large number of commands available.

It's almost a maxim that flexibility implies a certain complexity, and there just aren't enough keys on a keyboard to incorporate all of WordStar's commands without multiple keystrokes. WordStar's designers deliberately avoided the use of any special function keys which may be available on a given terminal, not only for portability but also because use of such keys is less comfortable and may actually slow throughput for experienced typists.

```
          ^Q PREFIX                        (to cancel prefix, hit SPACE bar)
CURSOR:   S=left Side screen    E=top screen    X=bottom       D=right enD line
          R=beginning file      C=end file      0-9, B, K, V, P = to marker
SCROLL:                    Z=continuous up      W=continuous down
DELETE TO END LINE:       DEL=left              Y=right
FIND, REPLACE:            F=Find a string       A=find And substitute
REPEAT NEXT COMMAND:       Q=repeat until key hit
```

Table 5. ↑Q menu.

The ↑Q Menu

The ↑Q menu (shown in Table 5) begins with more cursor control sequences. The cursor can be moved to either side or the top or bottom of the screen, the beginning or end of the file or to special markers which can be embedded in the text. Markers numbered 0 through 9 are inserted with commands shown on the next menu and allow jumping to specified places in the text. This is very useful with long files to mark and find the beginning of chapters, tables, etc. The cursor can also be moved to the beginning or end of marked blocks (explained later), the place where a block was moved from or to the position where the cursor was before a command which moves the cursor was executed.

This menu also completes the list of deletion commands which began on the basic menu. Note that the commands are logically organized; most of the commands are extensions of the single keystroke commands with the prefix ↑Q. This makes learning the double keystroke commands a much simpler task.

WordStar can repetitively execute many commands. Entering ↑Q↑Q followed by the desired command will begin execution at a default speed. A prompt appears which allows the user to speed up or slow down the repetitive process or interrupt it entirely. There are many uses for repetitive commands, including ↑Q↑Q↑B to reformat an entire document, ↑Q↑Q↑Y to remove all lines after the current one, etc.

This menu also contains the sequences for WordStar's comprehensive find, search and/or replace mechanism. All these instructions work similarly and with a reasonably simple syntax, but the flexibility provided is impressive. When one of these commands is entered, Word-

```
       ^K PREFIX                          (to cancel prefix, hit SPACE bar)
END EDIT/SAVE:         D=Done edit    X=done, eXit     S=Save, reedit     Q=abandon
MARK BLOCK:            B=Block start  K=BlocK end      H=Hide/display
BLOCK OPERATIONS:      V=moVe block   C=Copy block     Y=delete block     W=Write
ADDITIONAL FILES       R=Read file    W=write block    J=delete file
  & PRINTING:          O=cOpy file    E=rEname file    P=Print a file
DISK & DIRECTORY:      L=change Logged disk             F=File directory on (OFF)
PLACE MARKERS:         0-9 = set/hide place marker 0-9
```

Table 6. ↑K menu.

Star prompts for the string to be found and, if a search and replace has been requested, the string to use as the replacement. The find string entered can contain special characters to specify classes of characters to match. ↑A matches any character, ↑S matches any character not a letter or digit, ↑Ox matches any character other than x, and ↑N matches the carriage return/line feed sequence. Although rarely used, these special "wild-card" characters permit very sophisticated searching procedures.

After obtaining the search and replace strings, the program prompts for any desired options, which include specifying the exact number of times to perform the operation, searching the entire file (global search), replacing without asking (the system normally moves the cursor to each located string, displays the surrounding area and asks if you do, in fact, wish to replace this particular occurrence), searching backwards instead of forwards, ignoring the distinction between upper and lowercase and searching for whole word occurrences only.

Global searches can be done without fear of changing an occurrence when you don't want to or changing a small part of a word unintentionally. How many of us have changed the word "date" to today's date on a file of multiple letters and accidentally also changed "candidate" to "candi-February 22, 1981"! With WordStar just specify option W and this can't happen.

Scrolling in either direction is provided. While acceptable in the forward direction, reverse scrolling is useful only on memory-mapped displays since a serial terminal must rewrite the entire screen. Most users will find it easier to page backwards rather than scroll.

The ↑K Menu

This menu is primarily concerned with file and block operations (see Table 6). Four ending sequences are available: the user can complete editing the current file and move on to editing a different one, complete the edit and exit WordStar to return to CP/M, save the current file and return to editing it (a useful safety option) or abandon the current edit in progress. WordStar automatically creates a backup file whenever it saves an edit or exits, so the previous version is always available in case of problems.

A block is a section of text which can be of any length. When the beginning and end points of the block are defined, WordStar highlights the entire block so there is no confusion

about the segment of text to be operated upon. The highlighting can be turned on or off ("hidden" or "displayed" in WordStar terminology), and the cursor can be moved to the beginning or end points as described earlier.

Once a block is defined, it can be moved to any other location in the file by simply moving the cursor to the desired destination and executing the ↑K↑V command. Similarly, a block can be copied to a new location, in which case the original block still exists at its original location, or a block can be deleted.

A block can also be written out to disk, and the program will ask what filename the block should be saved under. Blocks (or entire files) can also be read into the current file at the location of the cursor. This allows reading in boilerplate text, letterheads, etc., and makes generation of letters using standard paragraphs easy. Files can also be deleted, copied or renamed from this menu.

The logged disk feature changes the default disk (useful for getting a directory of a disk other than that from which WordStar was started) and toggles on or off the directory listing. If this feature is on, a complete directory is displayed (five files to a line) at all times between the basic menu and the ruler line. If the entire directory would occupy too much of the screen to allow convenient editing, WordStar displays only a few lines and allows the user to scroll the directory portion of the screen separately from the status displays and text.

↑K followed by a number between 0 and 9 sets the place markers (described earlier), which allow the cursor to be jumped around in a long file.

The final command on this menu prints a user-specified file. This seems simple enough until one realizes exactly what happens. WordStar can actually print one file while editing a completely different one! This is a form of multitasking, or spooling, and is a rarity on today's microcomputers. Keyboard response becomes rather sluggish in this foreground/background mode, however, so entry of text while simultaneously printing is likely to lose characters, especially if printing is directed through the CP/M LST: device.

The ↑O Menu

On-screen formatting is controlled by the commands listed in Table 7. Many of them are self-explanatory, but note that whatever formatting is specified occurs in full view on the screen. Margins can be set either to a specified column number or to the current position of the cursor; any desired tab stops can be set or cleared and are reflected in the tab ruler line below the status line; margins can be released as on a normal typewriter to allow hanging paragraphs; and various options can be toggled on or off. The status of several options is indicated on the menu itself by capitalizing and highlighting the status.

Version 2.26 allows special "soft" hyphens to be typed while text is entered if the ↑OE option is set. These "soft" hyphens (which are displayed highlighted) will only print if they appear at the end of a printed line. A normal "hard" hyphen always prints, so words like "mother-in-law" are handled correctly. Display of the soft hyphens (and other special WordStar characters embedded in the text) can be disabled to see exactly how printed lines will look.

In addition to regular tab stops, WordStar can set special "decimal tab stops." When the cursor is tabbed to such a column, numbers typed are entered to the left of the tab stop until a decimal point is typed. This makes entering numerical tables incredibly easy.

Tabs and/or margins can be set from a line in the file itself. If a line of dashes, exclamation points and pound signs is entered and the cursor is positioned on this line, the ↑OF command will automatically set regular tabs to the columns with exclamation points, decimal tabs to the columns with pound signs and the margins to the endpoints of the line. This is useful in setting up tabs for columnar tables, especially in reports which are prepared regularly; the tab line can be stored in the file and used to set up the format when the report is to be prepared again.

Finally, version 2.26 adds a "paragraph tabbing" feature, which temporarily indents the left margin to the next set tab stop until a carriage return is entered. This is very handy for outlines and other special formatting purposes.

The ↑P Menu

Table 8 shows the sequences to put a control character into the file. While this might be useful for special purposes, its main function is to control special printer actions. A wide variety of special functions can be decoded by the printing portion of WordStar. Underscoring (only the characters, not the spaces in between), boldface, double-strike, sub- and superscripts, ribbon color changes, overstriking a line (printing the same line of paper with two different lines of text), etc., are possible if your printer supports these functions. The newest version also supports strikeout and overprinting of single characters.

Pitch can be changed on daisywheel printers, printing can be momentarily suspended for typewheel changes, and the characters on some daisywheels which cannot normally be printed can be forced to print. A "non-break space" code, which prevents the word wrap routines from splitting a phrase at a space, can be entered; this is useful to prevent "February 22, 1981" from being split before the "22." Provisions are also made for calling in special user print-

```
                 ^O PREFIX: on-screen formatting commands
S=set line Spacing   C=Center cursor line       F=margins/tabs from File line
L=set Left margin    X=margin release           E=soft hyphen - Entry on (OFF)
R=set Right margin   W=Word wrap off (ON)       D= -, print ctrl dspy off (ON)
I=set tab stop       J=Justification off (ON) P=Page break display  off (ON)
N=clear tab stop     V=Variable tabs off (ON) T=Ruler display       off (ON)
G=paraGraph tab      H=Hyphenate-Help on (OFF)           SPACE=cancel prefix
```

Table 7. ↑O menu.

```
                ^P PREFIX: Put Control Character in File
V=subscript begin/end     T=superscript begin/end     Y=ribbon color change
S=underScore begin/end    B=Boldface begin/end        D=Double strike begin/end
A=Alternate pitch         N=standard pitch            X=strikeout begin/end
O=non-break space         F=phantom space             G=ph. rubout (see manual)
C=pause when printing     H=overprint next character RETURN=overprint next line
Q, W, E, R = user printer controls                    SPACE=cancel prefix
```

Table 8. ↑P menu.

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```
               ^J PREFIX: help commands
H = display and set Help level        M = Margins and tabs
F = Flags in right screen column      S = Status line
I = command Index; entering text      R = Ruler line
B = paragraph reform (^B command)     V = moVing text
D = Dot commands, print controls      P = Place markers
                                      SPACE=cancel prefix
```

Table 9. ↑J menu.

Command	Function	Comment
.LH	Line Height	Sets line height in 1/48 inch increments
.PL	Page Length	Sets number of lines on page
.MT	Margin at Top	Sets number of lines in top margin
.MB	Margin at Bottom	Sets number of lines in bottom margin
.HM	Heading Margin	Sets number of lines in heading margin
.FM	Footing Margin	Sets number of lines in footing margin
.PC	Page # Column	Designates column in which page number will appear
.PO	Page Offset	Sets number of columns entire printed output will be offset from leftmost column
.PA	new Page	Forces start of new page
.CP	Conditional Page	Forces start of new page if specified number of lines not available on current page
.HE	Heading	Defines heading string to appear on each page
.FO	Footing	Defines footing string to appear on each page
.OP	Omit Page #'s	Turns page numbering off
.PN	Page Number	Turns page numbering on starting at specified #
.CW	Character Width	Sets character width in 1/120 inch increments
.SR	Subscript Roll	Sets height in 1/48 inch increments of sub- and super-script offset from main line
.UJ	Microjustify	Toggles microjustification on/off
.BP	Bidirectional Printing	Toggles bidirectional printing on/off
.IG	Ignore	Comment

Table 10. ↑Dot commands.

er control routines (for double width or double height characters, etc.) the user may have patched in.

The ↑J Menu

These sequences (see Table 9) provide helpful messages for beginning users or to remind more experienced users about infrequently used commands. The flags mentioned are special characters which WordStar displays in the far right-hand column of the video display and which indicate continuation lines (WordStar can easily handle line widths longer than 80 characters), "hard" carriage returns that mark the end of paragraphs, overstrike lines, abnormal conditions, etc.

Up to this point all the formatting commands have been reflected immediately on the video screen. WordStar also uses the embedded command system employed by separate text output processors. These "dot commands" (see Table 10) are entered with a period in the first column followed by a two-character command and any necessary parameters.

Dot commands control various printing options, including setting line height (in 1/48 of an inch on daisywheel printers), paper length, top and bottom margins, heading and footing margins, pagination on/off/set to a different number, conditional paging, page offset (to move the entire page a specified number of columns to the right for printer alignment), establishment of heading or footing text to appear on each page, changing character width (pitch) on specialty printers and specifying the location of the page number.

Mail-Merge

Mail-Merge is an optional module which provides enhanced printing capabilities, primarily the preparation of form letters, insertion of variable data into a document during printing, insertion of external files into the printout and printing multiple copies.

Mail-Merge has its own special set of dot commands which are listed in Table 11. The commands which specify the data file to be used and the named variables to read in order from the file operate in a straightforward manner and allow disks to be changed prior to reading the data file so that files too big to fit on one disk can be accommodated.

Other commands allow setting the value of variables which will appear throughout a document or accepting the value from the operator with prompting. The interaction with the operator can be enhanced with messages, screen formatting and other techniques. Named files can be included at print time, with up to eight-level nesting.

Variable names are inserted into a text file surrounded by ampersands. When the data file is read, the value of the variable read from the file will be substituted in the body of the text. Mail-Merge has several commands which control the reformatting of the printed output to accommodate the varying length of the substituted string. Most interesting is the fact that Mail-Merge can examine the input file to determine if it was justified or ragged-right or what margins were used, and will use the same techniques and values for the output printing if the operator has not reformatted according to a different set of

Command	Function	Comment
.DF	Data File	Specifies data file to be used
.RV	Read Variables	Gives name and order of variables to be read from data file
.RP	RePeat	Repeat processing specified number of times
.SV	Set Variable	Sets variable to specified value
.AV	Ask for Variable Value	Asks for variable value from operator, with prompt if desired
.DM	Display Message	Displays message on console
.CS	Clear Screen	Clear screen and display optional message
.FI	File Insert	Inserts specified file in printout
.PF	Print-time Formatting	Toggles print-time formatting on/off or allows discretion
.RM	Right Margin	Sets right margin or allows discretion to use margin in original text
.LM	Left Margin	Same as .RM for left margin
.LS	Line Spacing	Sets line spacing or allows discretion to use spacing in original text
.OJ	Output Justification	Toggles justification on/off or allows discretion
.IJ	Input Justified	Forces interpretation of input as justified under certain circumstances

Table 11. ↑Mail-Merge dot commands.

assumptions.

If a data file is read, Mail-Merge will continue repeating its printing task until the data file is exhausted. There are no provisions to selectively print records based on variable values or other criteria.

Mail-Merge is not as powerful as the similar provisions included with Magic Wand and some other word processors but performs satisfactorily in most applications.

Drawbacks

WordStar has a few drawbacks. First, it is costly. Not only is its selling price of $495 among the highest for a microcomputer word processor, but WordStar is also rather extravagant with both RAM memory and disk storage. Including CP/M and some working text areas, WordStar requires 45K of RAM, and an additional 3K is needed if simultaneous printing and editing is desired. 2K less is needed if a memory-mapped video board is used. With the "minimal" 45K system, the text buffers will be a bit small, necessitating more frequent disk accesses and somewhat slower operation.

WordStar's associated message file is 24K long in the newest version and the overlay file is 28K. With the 14K main WordStar file, about 66K of disk storage is consumed (add another 8K for the Mail-Merge module option). Remember also that formatted WordStar files can be very long because of all the embedded control characters (and the backup files are equally long), so the disk storage problem is even more severe if long files must be edited.

These problems certainly will affect some potential users much more than others. Users with eight-inch disk drives will not experience much difficulty, especially if double density is available, but mini-disk users will have to plan disk storage carefully (of course, WordStar can reside on one disk while the files to be edited are on another if you have a multiple disk system).

WordStar does not officially support true proportional spacing on those printers capable of this function. There is an unsupported and experimental implementation of proportional spacing which works reasonably well but is a bit difficult to use (insert control-P at the beginning of the file; this works only on lines which WordStar has formed and sometimes will not work on short lines). WordStar, like most word processors, also allows only one text file to be manipulated at a time. Some new programs allow multiple files to be open at the same time, facilitating movement of text from file to file without intermediate disk files.

Summary

WordStar is clearly one of the most, if not *the* most, powerful word processors available for microcomputers. In fact, I have used many large mainframe and dedicated word-processing systems costing tens of thousands of dollars which do not approach WordStar's power and flexibility. The documentation is excellent, although somewhat technically oriented in spots, and provides some help in training clerical staff on this complex system.

If your system can handle its RAM and disk storage requirements and you can afford its cost, MicroPro's impressive WordStar word processor is an excellent choice. ■

6502 + two 6522s + four DIP cables = 2716 programmer.

A Proven Formula To Program 2716s

By George Young

I had just blown my sixth 2716 when I couldn't even afford to blow the first one. So I decided to seek professional help—the JBE 2716 Programmer (from John Bell Engineering, PO Box 338, Redwood City, CA 94064).

The JBE 2716 EPROM Programmer was designed to use the JBE 6522 parallel interface board and four 16-pin DIP cables to couple to an Apple computer to program 2716s. Since my homebrew 6502 has two 6522 versatile interface adapters (VIAs) on its I/O board, and I had several DIP headers on hand, I didn't order the 6522 parallel interface board or the DIP cables which JBE offers as options.

Assembly of the board took a whole 20 minutes. The only problem you might possibly have is how to substitute plastic packaged transistors for metal-can transistors. Actually, if you look carefully at the silkscreen on the component side of the circuit board, it does show both transistor configurations. I would suggest mounting the 24-pin Textool Zero Force Insertion Socket with the lever on the 2716 pin-1 end. It will go on the board either way (with the lever near pin 1 or with the lever toward pin 12) and function equally well.

The reason for mounting it with the lever near pin 1 is that the silk-screen notched IC indicator completely vanishes beneath the Textool Socket once the socket is mounted. At some later date, you may not remember which way to insert your 2716s for programming, and the lever on pin 1 will serve to aid your memory.

Programming 2716s

Details for programming 2716s are included in the documentation with the 2716 kit. The data to be written to the 2716 is placed from 2000 hex to 27FF hex. The software that actually tells the two 6522s what to do is placed at 1000 hex. When the software reads the 2716 EPROM, it writes the EPROM bytes to 3000–37FF.

Now, my 6502 doesn't quite have all the memory that an Apple has (nor the price tag, either), so the first thing I had to do was move John Bell's software to address 0200 hex. Then I had to tell the 6522s to write the EPROM from addresses 1000–17FF and when reading the EPROM to store the EPROM bytes at 1800–1FFF. This was done without great problems once I was able to figure out exactly what JBE was doing with its software.

I'm sure that the testing I gave the JBE 2716 programmer far exceeds anything you or JBE might anticipate. I had already blown more 2716s than I could afford to blow. I was not about to insert another until I had thoroughly tested things out and assured myself that the programmer met all the Intel specifications set forth in the Memory Data Book for the 2716.

The four DIP cables from the 6522s went to the breadboard of the Design Console (see Kilobaud Klassroom June 1977, p. 78). The outputs of the 6522s were buffered and used to drive LED indicators that monitored addresses and data. The built-in logic probes of the Design Console monitored the PD/PGM lines and the +25 V line.

Delay routines were then written and patched into the JBE code. Now it was possible to run the software very slowly and see exactly how the JBE 2716 EPROM Programmer functioned and that it met each and every detail of the Intel 2716 programming specs.

JBE Code Modification

I added the following four bytes of code to the JBE code at address 10A4 in the JBE software:

C9 FF/F0 24

and then changed the subroutine call at address 1079 from 20 A8 10 to 20 A4 10. This change causes the bytes that are to retain the value FF to be skipped. This, in turn, allows the entire 2716 to be only partially programmed, and reduces the time to program the 2716 from 102 seconds for 2048 bytes to less than 102 seconds in proportion to the number of bytes left unprogrammed. This code change is not required, but it does serve a logical need and speeds up programming if you are not utilizing every byte of the 2716 matrix.

Once I was convinced that things were behaving as they were supposed to, the delay routines were removed and the code run at full machine speed. 102 seconds later the

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JBE 2716 EPROM Programmer LED monitor turned off as per the designer's statements of what is supposed to happen.

Several hours then elapsed while I wrote code to be placed in EPROM. Once this code was error-free (?), an Intel 2716 went into the Textool Zero Force Insertion Socket, and about 100 seconds later (some of the bytes were left unprogrammed) I had a programmed 2716 for use in my computer. I then discovered that the 'error free' code wasn't, and made the necessary corrections to the code and burned another EPROM. The EPROM with the bum code in it went into the EPROM Eraser and then back into stock.

Errors

JBE: Please make the following corrections to the documentation:

1) Line from pin 3 to J4 to pin 19 of EPROM socket should be A10 instead of A11.

2) Reverse arrow on emitter of Q3 to indicate an NPN transistor instead of a PNP transistor.

Assembly Help

1) Resistors and diodes mount on the board first, then the sockets, followed by the capacitors. The Zero Force Insertion Socket goes on last.

2) The electrolytics are marked ⇨, or the negative end of the electrolytics are flagged. The board is marked for a positively flagged electrolytic. Use caution and get the electrolytic capacitors onto the board with the correct polarity.

3) One of the disk capacitors called for is .001 uF. This cap may be marked 102. (The indication means 1000 pF, which is .001 uF.)

4) The substitution of plastic packaged transistors for metal-can transistors was discussed earlier in the article.

5) Either mount the Textool Zero Force Insertion Socket with the notched end of the silk-screen indication and the Textool lever together, or place a piece of tape on the board to indicate the notched end of the 2716, or both.

Summary

It works like a charm. It programs Intel 2716s nicely. I also blew a 5-volt-only National 2716 with the programmer, but that's another story. Stick with Intel 2716s and you'll have no problems.■

✓See List of Advertisers on page 194

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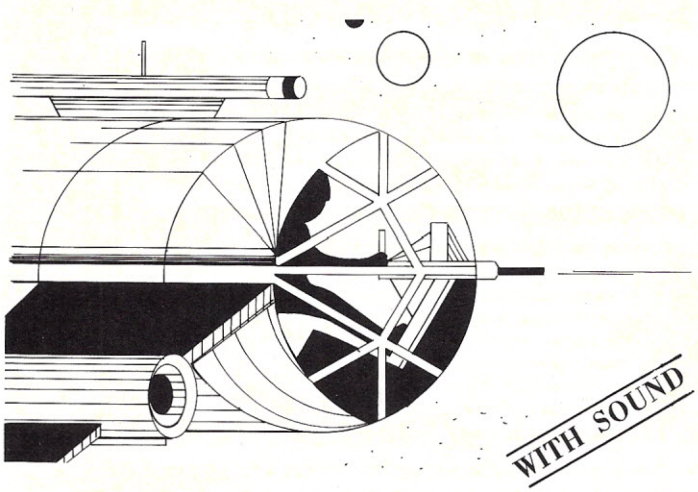

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1.3 In addition, alien ships can make instantaneous hyperspace jumps into your area and start firing on your ship.
1.4 You'll need lightning reflexes and nerves of steel to survive Danger In Orbit. We have no use for non-survivors!

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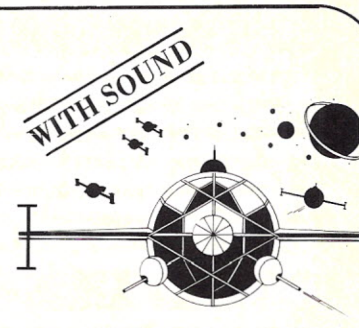

For years the Petro Resource Conglomerate has attacked our photon collection stations and strangled our deep-space trade routes. The PRC Exxonerator Class light fighters (code name: Gnat) have been their main weapon. Now you can strike back, by joining the Ball Turret Gunner Service.

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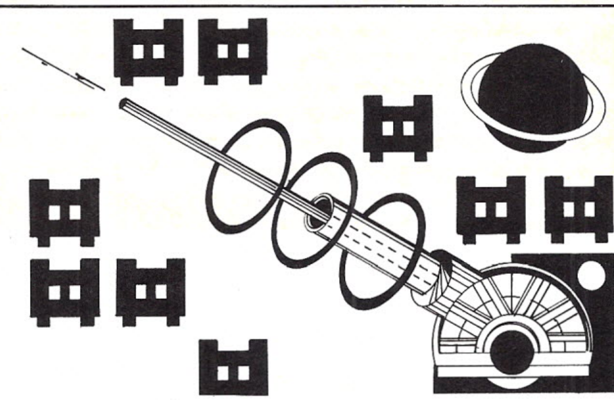
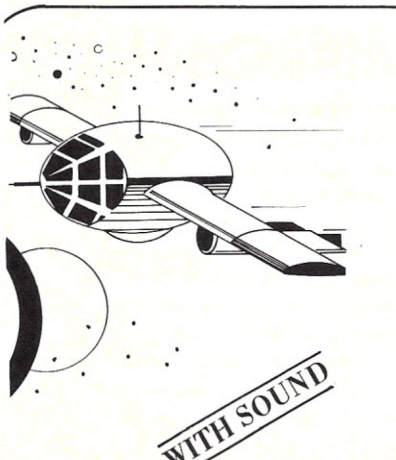


COSMIC PATROL



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Here's an easy machine-language implementation of the IEEE 488 (GPIB) bus via SRQ line interrupts.

Get on the PET Instrument Bus

By Kepa Zubeldia

I followed the series on the IEEE 488 bus of the PET by Gregory Yob (July–September 1980 *Kilobaud Microcomputing*), and I think this will become a key reference text to PET users, especially those involved with instrumentation. My own experience with the GPIB and the PET should be useful. In my application, I had to interface the PET with an A/D converter to analyze data (simple weighted average) and display the results on the screen. It looked simple.

I chose the smallest PET, 8K RAM with built-in recorder and the HP47310A (same as HP59313A but painted white for hospital use) four-channel A/D converter with internal pacer.

After a few tries with the bus, I mastered the protocol sufficiently to select the channel on the converter and take readings. Since the A/D converter does not send a return at the end of the message, the program had to take the readings with a GET instruction inside a loop that checks for the status word.

Next I sent the command to turn on the converter's internal pacer, which was adjusted to take ten samples per second, while my loop kept waiting for the reading. It was so simple.

I also needed to switch channels and adjust the pacer rate in the converter between samples, so it would sample channel 1 every 200 ms and channel 2 every 600 ms. This was done with a table of sequential commands sent to the GPIB.

However, when I tried to add the algorithm to process all the information that the converter was sending, the program became too slow and began dropping samples. I improved the algorithm but nothing changed. The improved version of the algorithm was taking more than my 200 ms limit, and even if it was executed only once per second, it was too long.

As a temporary solution, I defined a 4K buffer which would store about 12 minutes of samples and then stop sampling and analyze that data. This proved unsatisfactory because of the discontinuous sampling and the time delay in the presentation of the results.

A solution emerged when I read *The PET Revealed*, published by Computabits Ltd., PO Box 13, Yeovil, Somerset, England. This is by far the best description available of the (old) PET and its inside magic.

Servicing the SRQ

The GPIB has an SRQ line that is made true (0) when an instrument in the bus needs service. The software needed to acknowledge this SRQ is not part of the PET ROMs, so this line is listed as unimplemented. However, the line is connected to the handshake line (CB1) of the PIA 2 and thus can generate interrupts to the microprocessor.

Whenever an interrupt is generated in the PET, it will jump to the address pointed to by locations 537 and 538. These locations point to the routine that flashes the cursor, updates the TI clock and scans the keyboard.

If you interfere with this vector in 537 and 538 and make it point to your own machine-language subroutine, it will jump there 60 times per second, because the PET is being interrupted at 60 Hz by the retrace line of the video display. All this is done in the background and is invisible to the user and to BASIC.

Therefore, you can make the SRQ line of the GPIB generate interrupts in the PET. But first there must be a machine-language routine to decide whether the interrupt was generated by the retrace line of the PET or the SRQ of the GPIB, and to service the corresponding source. This would also be invisible, and would run as a background job. Of course, it would slow down the foreground job (BASIC program or other machine-language program), but it would have the advantage of allowing indepen-

Kepa Zubeldia, 1820 E. Lindsey, Norman, OK 73071, is a medical doctor currently working on a PhD in Engineering.

dent work of the GPIB.

There is a drawback—the interrupts are also used during cassette operations, so your background GPIB job will not run simultaneously with the PET cassette. The pointer must be restored to its original routine in ROM before cassette operations can be executed.

An example of implementation appears in the machine-language program shown in Listing 1. It is hand assembled and fits in the second cassette buffer with some room left over. The program checks for the SRQ line 60 times per second. If the SRQ is false (1), it will jump to the PET ROM interrupt-handling routine; if it is true (0), it will jump to the servicing routine for the A/D converter, which takes the data from the converter and saves it in a buffer, then sends some commands to the converter and finally jumps to the PET ROM interrupt-handling routine that originated the interrupt. While all this is done in the background, the BASIC program in the foreground is analyzing the data of the buffer that is being continuously updated by the background process.

In the program presented here, the interrupts are generated by the retrace line because it is the most frequent event (retrace at 60 Hz vs GPIB at 6 Hz). If your GPIB is requesting service more frequently than the retrace line, the interrupts should be generated by the SRQ. But if you inhibit the retrace interrupts, chances are that your PET will not like it; if the GPIB stops requesting service, the PET will not respond to the keyboard.

I suggest that you try this from a program (not from the keyboard): Use POKE 59411, PEEK(59411) AND 252 to inhibit retrace interrupts; the PET will not respond to the keyboard, not even the STOP key, and the cassette motor will be dead. Use POKE 59411, PEEK(59411) AND 252 OR 1 to enable the retrace interrupts and the PET will come to life again. If, instead of using 59411, you use 59427, you will be referring to the interrupts generated by the SRQ of the GPIB.

Example Program

The comments on the listing of the machine-language program (Listing

Listing 1. Machine-language implementation.

```
826     033A   78           SEI          ;Disable interrupts.
        033B   A9 03        LDA #$03     ;New high byte for interrupt
        033D   8D 1A 02     STA $021A    ;processing routine address.
        0340   A9 54        LDA #$54     ;Low byte of the address.
        0342   8D 19 02     STA $0219    ;
        0345   58           CLI          ;Enable interrupts.
        0346   60           RTS          ;Return to BASIC.
                                         ;This has changed the pointer
                                         ;of the interrupt servicing
                                         ;routine to point to our new
                                         ;routine in the second cassette
                                         ;buffer.
839     0347   78           SEI          ;Disable interrupts.
        0348   A9 E6        LDA #$E6     ;Original high byte (OLD ROM)
        034A   8D 1A 02     STA $021A    ;for interrupt proc. routine.
        034D   A9 85        LDA #$85     ;Original low byte of address
        034F   8D 19 02     STA $0219    ;in OLD ROM.
        0352   58           CLI          ;Enable interrupts.
        0353   60           RTS          ;Return to BASIC.
                                         ;This has set the pointer to
                                         ;the original interrupt routine
                                         ;in the ROM of high memory.
                                         ;Now the regular cassette
                                         ;operation is restored and the
                                         ;background servicing of the
                                         ;GPIB is suspended.
IRQNEW  0354   08           PHP          ;Save processor status and
        0355   48           PHA          ;save accumulator in stack.
        0356   AD 23 E8     LDA $E823    ;Get SRQ line in bit 7 of acc.
        0359   30 13        BMI SRQTRU   ;If SRQ true, go and service it.
GOTOLD  035B   68           PLA          ;Recover accumulator from stack.
        035C   28           PLP          ;Recover status word from stack.
        035D   4C 85 E6     JMP $E685    ;Continue the interrupt
                                         ;processing with the original
                                         ;interrupt routine of the
                                         ;OLD PET ROM.
                                         ;This branches to the SRQ
                                         ;service routine if the GPIB is
                                         ;requesting service, otherwise
                                         ;executes the original routine
                                         ;in the ROM.
SETATN  0360   A9 00        LDA #$00     ;Clear the acc. (See text).
        0362   8D 1D 02     STA $021D    ;Set the flag   (See text).
        0365   AD 40 E8     LDA $E840    ;These three lines set the
        0368   29 FB        AND #$FB     ;ATN line true in the GPIB
        036A   8D 40 E8     STA $E840    ;without changing anything else
        036D   60           RTS          ;Return to calling program.
```

More →

Listing 1 continued.

```
                                                ;This sets the ATN line true
                                                ;before sending any address to
                                                ;the GPIB. ATN will be set
                                                ;false by the routine in ROM
                                                ;that sends the address.
SRQTRU  036E    98              TYA             ;Copy the Y index to accum.
        036F    48              PHA             ;Save it in the stack.
        0370    A9 3C           LDA #$3C        ;Disable IRQ from PIA and then
        0372    8D 13 E8        STA $E813       ;no interrups from retrace.
        0375    20 60 03        JSR SETATN      ;Set ATN true.
        0378    A9 46           LDA #$46        ;This is the TALK address.
        037A    20 80 F1        JSR $F180       ;Send the TALK addr. (OLD ROM).
        037D    20 27 F2        JSR $F227       ;Get a byte from GPIB.
;This byte is discarded in my application. Add here your code to process this
;byte if you need it.
        0380    20 27 F2        JSR $F227       ;Get another byte from GPIB.
        0383    AC E3 03        LDY BUFPNT      ;Load my memory buffer pointer.
        0386    91 01           STA ($01),Y     ;Save the byte in the buffer.
        0388    AD 22 E8        LDA $E822       ;Enable further SRQ from PIA#2.
        038B    20 60 03        JSR SETATN      ;Set ATN true.
        038E    A9 26           LDA #$26        ;This is the LISTEN address.
        0390    20 80 F1        JSR $F180       ;Send the LISTEN add.(OLD ROM).
        0393    AC E2 03        LDY CMDPNT      ;Load the command pointer.
        0396    B9 D2 03        LDA CMDSEQ,Y    ;Get next comm. to send to GPIB.
        0399    20 2C F1        JSR $F12C       ;Send acc. to GPIB (OLD ROM).
        039C    88              DEY             ;Update command pointer.
        039D    B9 D2 03        LDA CMDSEQ,Y    ;Get next command to send.
        03A0    20 2C F1        JSR $F12C       ;Send it to GPIB (OLD ROM).
        03A3    88              DEY             ;Update command pointer.
        03A4    10 02           BPL UPDBUF      ;If comm. seq. not finished.
        03A6    A0 07           LDY #$07        ;Restore command pointer.
UPDBUF  03A8    8C E2 03        STY CMDPNT      ;Save updated command pointer.
        03AB    AC E3 03        LDY BUFPNT      ;Get the memory buffer pointer.
        03AE    C8              INY             ;Update it for next time.
        03AF    8C E3 03        STY BUFPNT      ;Save updated buffer pointer.
        03B2    D0 0C           BNE GETOUT      ;If no page crossing.
        03B4    E6 02           INC $02         ;Increment buffer page pointer.
        03B6    A9 20           LDA #$20        ;This is the highest page.
        03B8    C5 02           CMP $02         ;Compare to buffer page pointer.
        03BA    D0 04           BNE GETOUT      ;If not above highest page.
        03BC    A9 18           LDA #$18        ;This is the lowest page.
        03BE    85 02           STA $02         ;Restore buffer page pointer.
GETOUT  03C0    68              PLA             ;Get Y index from stack to acc.
        03C1    A8              TAY             ;Restore original Y index.
        03C2    A9 3D           LDA #$3D        ;Enable IRQ from PIA and then
        03C4    8D 13 E8        STA $E813       ;Enable interrupts from retrace.
        03C7    4C 5B 03        JMP GOTOLD      ;Continue with the PET ROM to
                                                ;give service to the IRQ that
                                                ;originated this execution.

CMDSEQ  03D2    47 31           .TXT 'G1'       ;This is the command sequence
        03D4    46 31           .TXT 'F1'       ;that is sent to the GPIB, two
        03D6    46 32           .TXT 'F2'       ;bytes each time the SRQ is
        03D8    47 31           .TXT 'G1'       ;given service. At the end of
                                                ;the sequence, the pointer is
                                                ;restored to the beginning.
                                                ;
                                                ;
CMDPNT  03E2    07              .BYT $07        ;This is the pointer for the
                                                ;command sequence above.
BUFPNT  03E3    00              .BYT $00        ;This is the pointer for the
                                                ;memory buffer.
```

1) are self-explanatory.

The section labeled 826 causes the interrupt vector at locations 537 and 538 to point to the interrupt controller (IRQNEW) that services the GPIB if SRQ is true, and services the retrace if SRQ is false.

The section labeled 839 restores the original interrupt vector to the interrupt-processing routine in ROM in the PET. This is the reverse function of the previous section.

These two sections are called from BASIC (see Listing 2) using the SYS function. An interrupt from the retrace line could occur in the middle of these calls, and then the vector of 537 and 538 would be undefined, so they should be executed with the interrupt disabled as shown in those sections.

The section labeled IRQNEW is the new interrupt-dispatching routine. When an interrupt is generated by the retrace line, the processor gets the vector from 537 and 538, and, as it has the address of IRQNEW, it begins executing this code. After saving needed information in the stack, it checks the SRQ line. If this line is true, it will give service to the GPIB and then to the PET retrace interrupt; otherwise, it will service only the PET retrace.

Here the stack is used as a safe place to store needed information that the GPIB routine would destroy. The information is recovered from the stack before going to the ROM routine. Make sure you do this if you want to preserve the process of your foreground program.

The section labeled SETATN is a subroutine to set the ATN line true (0) prior to sending addresses to the GPIB. It also sets the flag to zero. If the flag is zero or $FF, the EOI line will not be made true during the transmission of that byte. This is a re-

quirement of the routine in the PET ROM.

The main GPIB service program is labeled SRQTRU. It begins saving the Y register in the stack, as this program will use it, and then inhibits further interrupts from the retrace, in case the GPIB protocol takes too long to complete. It then sends the talk address of the A/D converter that is requesting service.

The converter talks back and sends two bytes. I do not need the first byte, so I discard it. The second byte is saved in the buffer in high memory, using an indirect address stored in 1 and 2 (these locations are commonly used for the USR function), and an offset pointer.

The next step is to read register B of PIA 2, even if it is defined as output. This resets the logic inside PIA 2 so it will process the next SRQ; this can be done any time before exiting, but it must be done.

You will notice that the entry point I used to get a byte from the bus is different from the one listed by Yob. This is because my entry point checks first for the status word, and if it is different from zero it will not go to the GPIB handshaking protocol. Of course, this is optional, and his entry point ($F187) works perfectly too.

In his table Yob does not indicate how to send the talk and listen address to the instruments. The entry point is $F180 (61824) for the old PET and $F185 (61829) for the new PET. This will send the contents of the accumulator as a talk/listen address—a talk address in the range $40 to $5F and a listen address in the range of $20 to $3F. You can address all instruments in the GPIB, even in the range 0 to 3 where the PET has the keyboard, video display and cassette recorders.

Having set the ATN true with the subroutine, I now send the listen address to my GPIB device number 6, and then send the character from my command sequence to the bus. Here again I use a different entry point. My entry point will complement the accumulator, store it in the $0222 buf-

```
10 POKE 132,0 : POKE 133,24 : REM set top of string space
20 POKE 134,0 : POKE 135,24 : REM set top of memory
30 POKE 1,0 : POKE 2,24 : REM set base of buffer address
40 FOR I% = 826 TO 995
50 READ BYTE
60 POKE I%,BYTE
70 NEXT
80 OPEN 1,6
90 PRINT#1,"H1LEJ";
100 SYS(826)

        Here goes the foreground program, while
        the GPIB is being serviced in the background

Use SYS(839) to suspend the background process
Use SYS(826) to resume the background process

The buffer pointer is found from the foreground with:
PO=PEEK(2)*256+PEEK(995)
```

Listing 2. BASIC program.

fer and then jump to $F0F1 to send it. This is very easy to use, but as you do not have access to the accumulator from BASIC, you can only use this entry point from machine language. If you want to do it from BASIC, use the procedure that Yob explained in the text.

After sending a couple of characters from the command sequence, I update the pointers and check for page boundaries and buffer full, and finally recover the original Y index from the stack, reenable interrupts from retrace and then jump to continue the processing of the retrace interrupt.

This process fills the memory buffer in the background, and the program in Listing 2 uses this buffer for the calculations done in the foreground. If the device is very slow, you will notice some delay in the foreground program, but with the HP47310A you will not notice much difference and the timer function will work correctly.

The listing of the BASIC program (Listing 2) is self-explanatory. It reserves some memory for the buffer and then loads the machine-language program from data statements (not included) into the second cassette buffer. The file is open to the A/D converter and the first instruction string is sent to reset the converter, select the channel and pacing rate and enable the pacer and the SRQ of the converter.

A semicolon is used to inhibit the unlisten at the end, because unlisten would inhibit the SRQ of the converter. The PET has the CMD command to inhibit the unlisten at the end and thus leave the device connected to the bus. However, the CMD would redirect all output to the GPIB, and this is not what the A/D converter wants, so I use the semicolon.

Conclusion

This gives you an idea of how easy it is to use the GPIB from machine language in the PET, and a way to implement the SRQ function of the GPIB. Now I would like to see someone combine this with Yob's description of how to implement new functions in the PET, and implement an LPRINT function using spooling so the printer would work in parallel (not serial) with the BASIC program. ■

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MICRO QUIZ

(from page 26)

Answer: 10

I	Z
—	-1
2	$-3*1/-1=3$
3	$-5*3/3=-5$
4	$-7*5/-5=7$
.	.
.	.
.	.
10	$-19*17/-17=19$

Sum of Z's is $(3-1)+(7-5)+\ldots+(19-17)$.

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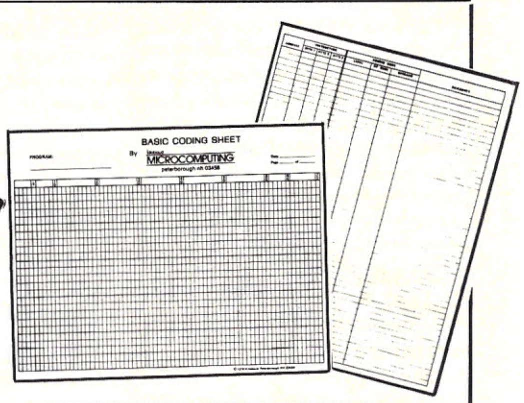

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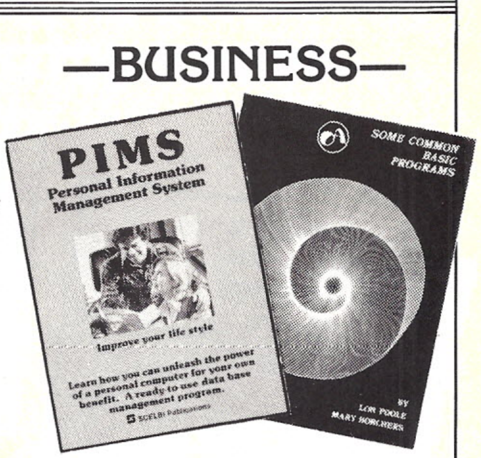

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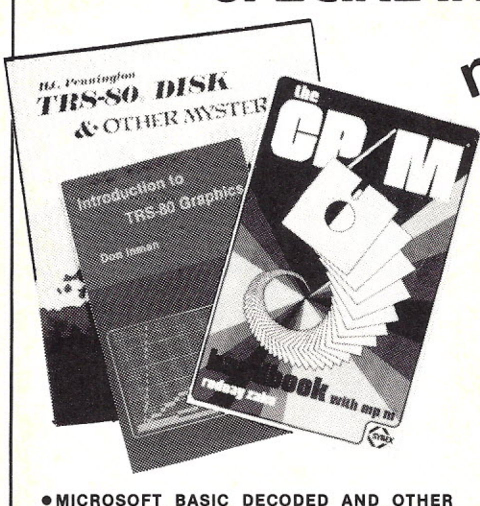

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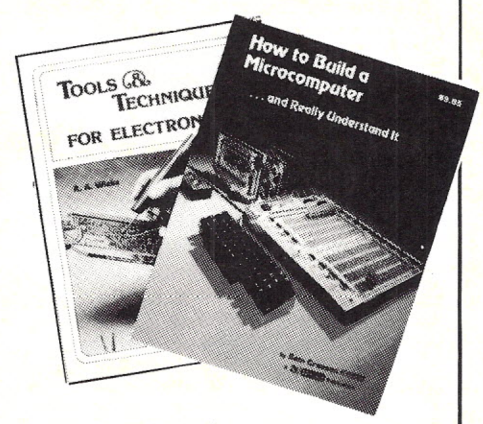

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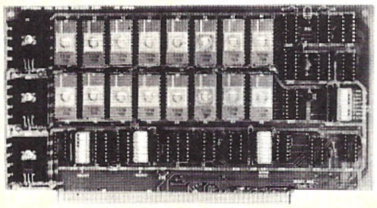

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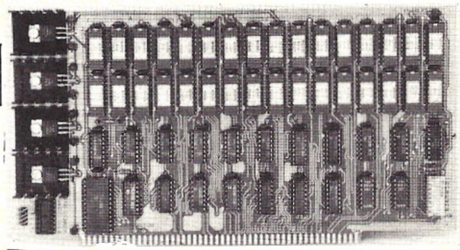

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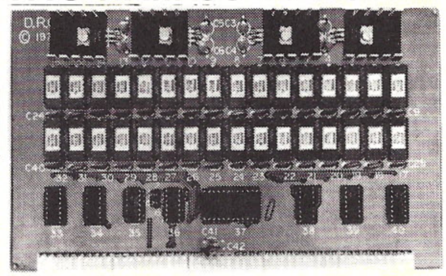

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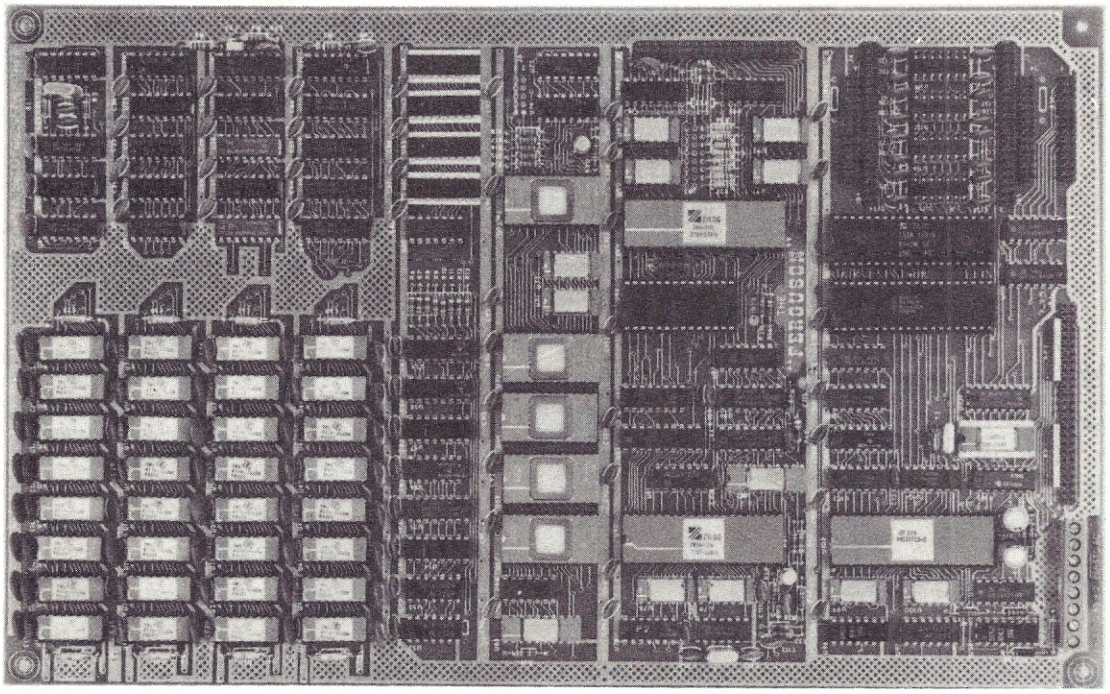

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Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. User selectable hand shake polarity. Set of all parts and connectors for parallel I/O: $29.95

REAL TIME CLOCK (OPTIONAL)

Uses Z-80 CTC. Can be configured as a Counter on Real Time Clock. Set of all parts: $14.95

SYSTEM COMPARISON

64K RAM KIT	$370.00
80 x 24 Video Kit	365.00
Floppy Disk Controller Kit	235.00
Z-80 CPU Kit	185.95
SER & PAR. I/O	129.95
S-100 Mother Board	45.00
SUB TOTAL	$1330.90

Talk about bangs per buck! The prices shown for S100 kits were taken from the July 1980 BYTE. This will give some basis for comparison between the Big Board and a similar system implementation on the S100 Buss.

CP/M* 2.2 FOR BIG BOARD

The popular CP/M* D.O.S. modified by MICRONIX SYSTEMS to run on Big Board is available for $150.00.

PC BOARD

Blank PC Board with Rom Set and Full Documentation. $199.00

PFM 3.0 2K SYSTEM MONITOR

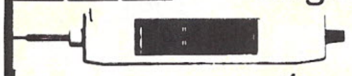
The real power of the Big Board lies in its PFM 3.0 on board monitor. PFM commands include: Dump Memory, Boot CP/M*, Copy, Examine, Fill Memory, Test Memory, Go To, Read and Write I/O Ports, Disc Read (Drive, Track, Sector), and Search. PFM occupies one of the four 2716 EPROM locations provided.
Z-80 is a Trademark of Zilog.

Digital Research Computers
(OF TEXAS)
P.O. BOX 401565 • GARLAND, TEXAS 75040 • (214) 271-3538

TERMS: Shipments will be made approximately 3 to 6 weeks after we receive your order. VISA, MC, cash accepted. We will accept COD's (for the Big Board only) with a $75 deposit. Balance UPS COD. Add $3.00 shipping.

*TRADEMARK OF DIGITAL RESEARCH. NOT ASSOCIATED WITH DIGITAL RESEARCH OF CALIFORNIA, THE ORIGINATORS OF CPM SOFTWARE
**1 TO 4 PIECE DOMESTIC USA PRICE.

CSC Logic Probe Kit.



17^{95} Complete, easy-to-follow instructions help make this a one-night project.

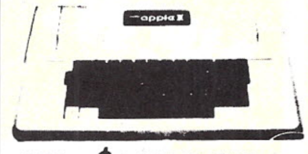
BUY 5 FOR $16.15 each

124^{95} apple clock/calendar
- Seconds, minutes, hours, day-of-week, month, date, & year.
- On board batteries with one year life.
- Uses MSM5832-crystal controlled.

APPLE CARDS

- SERIAL CARD → $159.00
- PARALLEL CARD → $99.00
- INTEGER or APPLESOFT CARD → $189.00
- PASCAL SYSTEM → $425.00
- PROTO BOARD → $25.00

"APPLE II Plus"



48k–$1199.00
64k–$1399.00

W/PURCHASE OF APPLE RECEIVE SPECIAL PRICING:

- BASE II PRINTER → $619.00
- DISK II w/cont. → $595.00
- DISK II w/o cont. → $495.00
- SUP'R'MOD II → $23.00
- MONITOR: B&W 12"–12MHz. → $125.00
- INTEGER BASIC CARD → $169.00

"LS" Super ☆SALE☆

74LS00	.26	74LS155	1.15	74LS54	.35	74LS243	1.45
74LS02	.26	74LS158	.75	74LS74	.38	74LS244	1.45
74LS03	.26	74LS160	.95	74LS75	.60	74LS245	2.25
74LS04	.26	74LS161	.85	74LS83	.44	74LS253	.95
74LS08	.28	74LS162	.95	74LS85	.95	74LS257	.95
74LS09	.26	74LS163	1.60	74LS86	.95	74LS258	.95
74LS10	.26	74LS164	.65	74LS90	.69	74LS259	2.85
74LS20	.26	74LS165	.65	74LS93	.69	74LS279	.44
74LS21	.28	74LS170	1.75	74LS107	.45	74LS283	1.00
74LS22	.26	74LS174	.75	74LS112	.38	74LS293	1.85
74LS26	.49	74LS175	.75	74LS113	.48	74LS298	1.20
74LS27	.26	74LS190	.75	74LS122	.48	74LS366	.95
74LS30	.28	74LS193	.95	74LS123	.95	74LS367	.55
74LS32	.32	74LS195	.95	74LS126	.69	74LS368	.55
74LS38	.32	74LS196	.85	74LS138	.69	74LS373	1.39
74LS42	.65	74LS221	1.40	74LS151	.44	74LS374	1.39
74LS48	.78	74LS240	1.65	74LS153	.44	74LS386	.65
74LS51	.25	74LS241	1.65				

TO-3 case
5 AMPS
5 VOLTS

MSM5832 MICROPROCESSOR REAL-TIME CLOCK/CALENDAR

XTAL. $3.85

GENERAL DESCRIPTION

The MSM5832 is a monolithic metal-gate CMOS integrated circuit that functions as a real time clock calendar for use in bus-oriented microprocessor applications. The on chip 32 768 Hz crystal controlled oscillator time base is counted down to provide addressable 4-bit I O data of SECONDS MINUTES HOURS DAY OF WEEK DATE MONTH and YEAR. Data access is controlled by 4-bit address, chip select, read, write and hold inputs. Other functions include 12H 24H format selection leap year identification and manual 30 second correction.

The MSM5832 normally operates from a 5 volt 5% supply. Battery back up operation down to 2.2 volts allows continuation of time keeping when main power is off. One test input facilitates rapid testing of the time keeping operations. The MSM5832 is offered in an 18-lead dual in line plastic (RS suffix) package.

FEATURES

- Microprocessor Bus oriented

TIME	MONTH	DATE	YEAR	DAY OF WEEK
23 59 59	12	31	99	7

- 4 BIT DATA BUS
- 4 BIT ADDRESS
- Read Write Hold Chip select inputs
- Interrupt signal outputs – 1024 1 1 60 1 3600 Hz
- 32 768 KHz crystal controlled operation
- Leap year register bit
- 12 or 24 hour format
- 30 second error correction
- Single 5 volt power supply
- Back up battery operation to VCC 2.2 V
- Low Power Dissipation 90 uw Max at VCC 3 V; 2.5 mw Max at VCC 5 V
- High Density 300 mil 18 Pin Package

$7.45

EPSON MX-80

$560.00

video 100

$129.00

Leedex Corp. 12" BLACK & WHITE LOW COST VIDEO MONITOR

COLOR $365.00 13"

Green Phos 12 inch. $155.00

SOROC

IQ120 $689.00

No "Glitches", Surges Or Interference

Marway's MPD 117 turns an ordinary outlet into a controlled power source for up to 8 devices

The MPD 117 is the low-cost solution to your power distribution problems

$79.50

Global Specialties Logic Probes

LP1 $40

LP3 $60

2716 5V 450NS	8.50ea	8 for	7.50ea
2708 450NS	4.75ea	8 for	4.50ea
2732	25.50ea	4 for	21.50ea
4116 300NS	3.00ea	8 for	19.50
4116 200NS	3.75ea	8 for	24.50
2114L 300NS	3.65 ea	4 for	13.95
2114L 200NS	4.00ea	4 for	14.95

MODEL 800

IMPACT PRINTER
- Dot resolution graphics in six densities
- 1920 character buffer
- Fully adjustable tractors to 9-1/2"

$649.00

base 2 inc.

UNIBOX ENCLOSURES SIX SIZES — NEW

Attractive grain finish high-impact ABS thermoplastic enclosures. Molded-in card guides & mounting bosses provide maximum versatility. Supplied with assembly hardware

ENCLOSURES

PART NUMBER	DIMENSIONS X		Y		Z	PRICE
110 *	1.25"	x	2.07"	x	2.77"	$2.85
120 *	1.50"	x	2.65"	x	3.75"	3.51
130 *	1.50	x	3.25"	x	4.38"	3.84
133 *	2.00"	x	3.25"	x	4.38"	4.28
140 *	1.50"	x	4.00"	x	5.30"	4.72
144 *	2.00"	x	4.00"	x	5.30"	5.16

* SPECIFY COLOR GRAY BROWN ORANGE

MATERIAL ABS

IC SOCKETS

PIN	
8	10/1.20
14	10/1.40
16	10/1.60
18	10/1.90
20	10/2.80
22	10/2.80
24	10/2.80
28	10/3.80
40	10/4.75

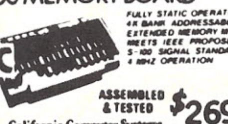
CPUs

Z-80	8.95
Z-80A CTC	12.50
Z-80A CPU	12.50
Z-80 002 16-64K	129.00
8085A	11.50
2901A	12.50
MC6800	9.50

New for the APPLE

MICROSOFT 16K RAM CARD $159.95

S-100 MEMORY BOARD



16K STATIC RAM

FULLY STATIC OPERATION
4K BANK ADDRESSABLE
EXTENDED MEMORY MGMT
MEETS IEEE PROPOSED S-100 SIGNAL STANDARDS
4 MHZ OPERATION

ASSEMBLED & TESTED $269.

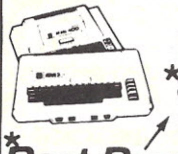
California Computer Systems

SUPER SALE!!

Apple Expansion Kit
16K Memory Add-On
Includes Instructions
$25.95

TRS80
16K Add-On
Instructions & Dip Switches
$25.95

ATARI® 800™ COMPUTER SYSTEM



- 400 Computer 8K → $419.00
- 800 Computer 16K → $779.00

*800 COMPUTER w/48K → $989.00

*Best Buy

ATARI PERIPHERALS:

Printer ("825")	$775.00	Printer ("822")	$379.00
Recorder	$65.00	Disk Drive	$565.00
Interface (850)	$175.00	Modem	$169.00
Paddles	$17.00	Joysticks	$17.00
Star Raiders	$49.00	Assembler Editor	$49.00
Space Invaders	$17.00	Music Composer	$49.00
Chess	$32.00	Mailing List	$17.00
Kingdom	$12.00	TV Switch Box	$8.95
Hangman	$12.00	16K RAM	$155.00
Blackjack	$12.00	8K RAM	$119.00

VISICALC
- APPLE → 129.
- ATARI → 154.

"1981" I.C. Master $59.95

MB8264-20 64K RAM w/ SPEC'S → $29.50

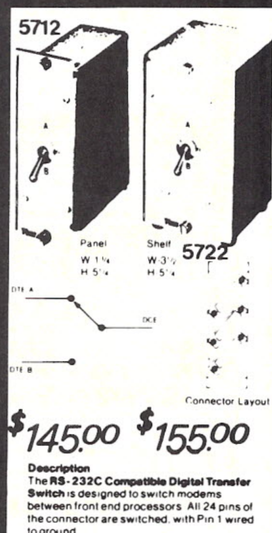
ER2051 EAROM → $4.50

P8155 → $19.50

"ALLOW 2 WKS. DEL'Y IF PERSONAL CHECK IS SENT."

MISC.

2102 450NS	1.20
8038	2.95
NE555	.27
AY5-1013A	4.50
1488	1.25
1489	1.25
8T26	1.30
8T28	1.30
8212	2.95
8216	2.95
IS410SCR	.95
IT410TRIAC	.95
7905	.85
7908	.85
7915	.85
7918	.85
7805	.85
7806	.85
7808	.85
7812	.85
MC1330A1P	1.60
MC1350P	1.15
MC1358P	1.50
LM380	1.20
LM565N	.95
LM741	.25
MC1458P	.55
LM720	.30



$145.00 $155.00

Description
The RS-232C Compatible Digital Transfer Switch is designed to switch modems between front end processors. All 24 pins of the connector are switched, with Pin 1 wired to ground.

T-bar INCORPORATED

CONCORD COMPUTER PRODUCTS

297

1971 SO. STATE COLLEGE
ANAHEIM, CALIF. 92806
(714) 937-0637

VISA master charge CHECK — M/O NO COD

☆send $1.00 for "81" catalog☆

$10. MIN ORDER / CA. RES. ADD 6% FRT.

7400

SN7400N	.25			SN74156N	.79
SN7401N	.20			SN74157N	.69
SN7402N	.25	SN7472N	.29	SN74160N	.89
SN7403N	.25	SN7473N	.35	SN74161N	.89
SN7404N	.25	SN7474N	.35	SN74162N	.89
SN7405N	.29	SN7475N	.49	SN74163N	.89
SN7406N	.35	SN7476N	.35	SN74164N	.89
SN7407N	.35	SN7479N	5.00	SN74165N	.89
SN7408N	.29	SN7480N	.50	SN74166N	1.25
SN7409N	.29	SN7482N	.99	SN74167N	2.79
SN7410N	.25	SN7483N	.69	SN74170N	1.95
SN7411N	.29	SN7485N	.89	SN74172N	4.95
SN7412N	.35	SN7486N	.35	SN74173N	1.39
SN7413N	.40	SN7489N	1.75	SN74174N	.99
SN7414N	.69	SN7490N	.49	SN74175N	.89
SN7416N	.29	SN7491N	.59	SN74176N	.79
SN7417N	.29	SN7492N	.45	SN74177N	.79
SN7420N	.25	SN7493N	.45	SN74179N	1.49
SN7421N	.29	SN7494N	.69	SN74180N	.79
SN7422N	.45	SN7495N	.69	SN74181N	2.25
SN7423N	.29	SN7496N	.69	SN74182N	.79
SN7425N	.29	SN7497N	3.00	SN74184N	2.49
SN7426N	.29	SN74100N	1.49	SN74185N	2.49
SN7427N	.25	SN74107N	.35	SN74190N	1.25
SN7428N	.49	SN74109N	.39	SN74191N	1.25
SN7430N	.25	SN74116N	1.95	SN74192N	.89
SN7432N	.29	SN74121N	.39	SN74193N	.89
SN7437N	.25	SN74122N	.55	SN74194N	.89
SN7438N	.40	SN74123N	.59	SN74195N	.69
SN7439N	.25	SN74125N	.49	SN74196N	.89
SN7440N	.20	SN74126N	.49	SN74197N	.89
SN7441N	.89	SN74132N	.75	SN74198N	1.49
SN7442N	.59	SN74136N	.75	SN74199N	1.49
SN7443N	1.10	SN74141N	.99	SN74221N	1.25
SN7444N	1.10	SN74142N	3.25	SN74251N	.99
SN7445N	.89	SN74143N	3.49	SN74276N	1.95
SN7446N	.79	SN74144N	3.49	SN74279N	.79
SN7447N	.69	SN74145N	.79	SN74283N	1.49
SN7448N	.79	SN74147N	1.95	SN74284N	3.95
SN7450N	.20	SN74148N	1.29	SN74285N	3.95
SN7451N	.20	SN74150N	1.25	SN74365N	.69
SN7453N	.20	SN74151N	.69	SN74366N	.69
SN7454N	.20	SN74152N	.69	SN74367N	.69
SN7459A	.25	SN74153N	.79	SN74368N	.69
SN7460N	.20	SN74154N	1.25	SN74390N	1.49
SN7470N	.29	SN74155N	.79	SN74393N	1.49

74LS

74LS00	.29			74LS192	1.15
74LS01	.29			74LS193	1.15
74LS02	.29	74LS92	.75	74LS194	1.15
74LS03	.29	74LS93	.75	74LS195	1.15
74LS04	.35	74LS95	.99	74LS197	1.19
74LS05	.35	74LS96	1.15	74LS221	1.19
74LS08	.29	74LS107	.45	74LS240	1.95
74LS09	.35	74LS109	.45	74LS241	1.95
74LS10	.29	74LS112	.45	74LS242	1.95
74LS11	.75	74LS113	.49	74LS243	1.95
74LS12	.35	74LS114	.49	74LS244	1.95
74LS13	.59	74LS122	.89	74LS245	2.95
74LS14	.99	74LS123	1.25	74LS247	1.19
74LS15	.35	74LS125	.89	74LS248	1.19
74LS20	.29	74LS126	.55	74LS249	1.19
74LS21	.35	74LS132	.99	74LS251	1.49
74LS22	.35	74LS133	.89	74LS253	.99
74LS26	.35	74LS136	.49	74LS257	.89
74LS27	.35	74LS138	.89	74LS258	.99
74LS28	.35	74LS139	.89	74LS260	.69
74LS30	.29	74LS151	.89	74LS266	.69
74LS32	.35	74LS153	.89	74LS273	1.95
74LS33	.59	74LS154	1.75	74LS279	.75
74LS37	.45	74LS155	1.19	74LS283	1.09
74LS38	.49	74LS156	1.19	74LS290	.99
74LS40	.35	74LS157	.89	74LS293	.99
74LS42	.89	74LS158	.99	74LS298	1.25
74LS47	.89	74LS160	1.15	74LS352	1.29
74LS48	1.15	74LS161	1.15	74LS353	1.29
74LS49	1.15	74LS162	1.15	74LS365	.75
74LS51	.29	74LS163	1.15	74LS366	.75
74LS54	.29	74LS164	1.25	74LS367	.75
74LS55	.29	74LS165	1.25	74LS368	.75
74LS73	.45	74LS168	1.19	74LS373	1.95
74LS74	.45	74LS169	1.19	74LS374	1.95
74LS75	.59	74LS170	2.49	74LS375	.89
74LS76	.45	74LS173	1.39	74LS386	.69
74LS78	.49	74LS174	.99	74LS393	2.49
74LS83	.89	74LS175	.99	74LS399	2.49
74LS85	1.25	74LS181	2.95	74LS670	2.49
74LS86	.45	74LS190	1.25	81LS95	1.95
74LS90	.59	74LS191	1.25	81LS97	1.95

74S

74S00	.50			74S243	3.25
74S02	.50			74S244	3.25
74S03	.50	74S124	2.49	74S251	1.45
74S04	.55	74S133	.55	74S253	1.45
74S05	.55	74S134	.69	74S257	1.35
74S08	.50	74S135	1.19	74S258	1.35
74S09	.50	74S136	1.75	74S260	.79
74S10	.50	74S138	1.35	74S280	2.95
74S11	.50	74S139	1.35	74S287	4.95
74S15	.50	74S140	1.15	74S288	4.95
74S20	.50	74S151	1.35	74S373	3.49
74S22	.50	74S153	1.35	74S374	3.49
74S30	.50	74S157	1.35	74S387	5.95
74S32	.55	74S158	1.35	74S471	19.95
74S38	.69	74S160	1.95	74S472	19.95
74S40	.55	74S174	1.59	74S473	19.95
74S51	.50	74S175	1.59	74S474	21.95
74S64	.50	74S188	4.95	74S475	21.95
74S65	.50	74S194	1.95	74S570	7.95
74S74	.79	74S195	1.95	74S571	7.95
74S86	.79	74S196	3.95	74S572	19.95
74S112	.79	74S240	2.95	74S573	19.95
74S113	.79	74S241	2.95	74S940	3.15
74S114	.79	74S242	3.25	74S941	3.15

CA—LINEAR

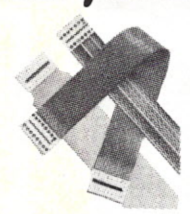
CA3010H	1.07			CA3089N	3.75
CA3013H	2.15	CA3060N	3.25	CA3096N	3.95
CA3023H	3.25	CA3080H	1.25	CA3130H	1.39
CA3035H	2.48	CA3081N	2.00	CA3140H	1.25
CA3039H	1.35	CA3082N	2.00	CA3160H	1.25
CA3046N	1.30	CA3083N	1.60	CA3401N	.59
CA3059N	3.25	CA3086N	.85	CA3600N	3.50

CD—CMOS

CD4000	.39			CD 4098	2.49
CD4001	.39			CD4506	.75
CD4002	.39			CD4507	.99
CD4006	1.19	CD4041	1.49	CD4508	3.95
CD4007	.25	CD4042	.99	CD4510	1.39
CD4009	.49	CD4043	.89	CD4511	1.29
CD4010	.49	CD4044	.89	CD4512	1.49
CD4011	.39	CD4046	1.79	CD4514	3.95
CD4012	.25	CD4047	2.50	CD4515	2.95
CD4013	.49	CD4048	1.35	CD4516	1.49
CD4014	1.39	CD4049	.49	CD4518	1.79
CD4015	1.19	CD4050	.69	CD4519	.89
CD4016	.59	CD4051	1.19	CD4520	1.29
CD4017	1.19	CD4052	1.19	CD4526	1.79
CD4018	.99	CD4053	1.19	CD4528	1.79
CD4019	.49	CD4056	2.95	CD4529	1.95
CD4020	1.19	CD4059	9.95	CD4543	2.79
CD4021	1.39	CD4060	1.49	CD4562	11.95
CD4022	1.19	CD4066	.79	CD4566	2.79
CD4023	.29	CD4068	.39	CD4583	2.49
CD4024	.79	CD4069	.45	CD4584	.75
CD4025	.23	CD4070	.55	CD4723	1.95
CD4026	2.95	CD4071	.49	CD4724	1.95
CD4027	.69	CD4072	.49	MC14409	14.95
CD4028	.89	CD4073	.39	MC14410	14.95
CD4029	1.49	CD4075	.39	MC14411	14.95
CD4030	.49	CD4076	1.39	MC14412	11.95
CD4034	3.49	CD4078	.55	MC14419	4.95
CD4035	.99	CD4081	.39	MC14433	13.95
CD4040	1.49	CD4082	.39	MC14538	2.49
		CD4093	.99	MC14541	1.95

A P PRODUCTS

DIP JUMPERS



- Mate with Standard IC Sockets
- Fully Assembled and Tested
- Integral Molded-On Strain Relief
- Line-By-Line Probeability

Dip Jumpers are used for jumpering within a PC Board; interconnecting between PC Boards, backplanes and mother boards; and interfacing input/output signals.

Part Number	No. of contacts	Description	Wire Length	Price
924102-12	14	single end	12"	$1.51
924102-24	14	single end	24"	1.92
924102-36	14	single end	36"	2.33
924106-12	14	double end	12"	2.61
924106-24	14	double end	24"	3.02
924106-36	14	double end	36"	3.43
924112-12	16	single end	12"	1.67
924112-24	16	single end	24"	2.13
924112-36	16	single end	36"	2.59
924116-12	16	double end	12"	2.88
924116-24	16	double end	24"	3.34
924116-36	16	double end	36"	3.80
924122-12	24	single end	12"	2.60
924122-24	24	single end	24"	3.30
924122-36	24	single end	36"	4.00
924126-12	24	double end	12"	4.50
924126-24	24	double end	24"	5.20
924126-36	24	double end	36"	5.90
924132-12	40	single end	12"	4.35
924132-24	40	single end	24"	5.53
924132-36	40	single end	36"	6.71

DISCRETE LEDS

XC556R	.200" red	5/$1	MV50	.085" red	6/$1	XC111R	.190" red	5/$1
XC556G	.200" green	4/$1	XC209R	.125" red	5/$1	XC111G	.190" green	4/$1
XC556Y	.200" yellow	4/$1	XC209G	.125" green	4/$1	XC111Y	.190" yellow	4/$1
XC556C	.200" clear	4/$1	XC209Y	.125" yellow	4/$1	XC111C	.190" clear	4/$1
XC22R	.200" red	5/$1	XC526R	.185" red	5/$1			
XC22G	.200" green	4/$1	XC526G	.185" green	4/$1			
XC22Y	.200" yellow	4/$1	XC526Y	.185" yellow	4/$1			
MV10B	.170" red	4/$1	XC526C	.185" clear	4/$1			

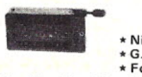
XC556 RED LED, METAL MTG. HDW. 2-6" LEADS.
RL-2 . . $.39 ea. or 3/$1.00

DISPLAY LEDS

C.A. — Common Anode | C.C. — Common Cathode

Type	Polarity	Ht	Price	Type	Polarity	Ht	Price
MAN 1	C.A.—red	.270	2.95	DLG507	C.A.—green	.500	1.25
MAN 2	5x7 D.M.—red	.300	4.95	DL704	C.C.—red	.300	1.25
MAN 3	C.C.—red	.125	.25	DL707	C.A.—red	.300	1.25
MAN 52	C.A.—green	.300	1.25	DL728	C.C.—red	.500	1.49
MAN 54	C.C.—green	.300	1.25	DL741	C.A.—red	.600	1.25
MAN 71	C.A.—red	.300	.75	DL746	C.A.—red ± 1	.630	1.49
MAN 72	C.A.—red	.300	.75	DL747	C.A.—red	.600	1.49
MAN 74	C.C.—red	.300	1.25	DL750	C.C.—red	.600	1.49
MAN 82	C.A.—yellow	.300	.49	DLO847	C.A.—orange	.800	1.49
MAN 84	C.C.—yellow	.300	.99	DLO850	C.C.—orange	.800	1.49
MAN 3620	C.A.—orange	.300	.49	DL33B	C.C.—red	.110	.35
MAN 3630	C.A.—orange ± 1	.300	.99	FND358	C.C. ± 1	.357	.99
MAN 3640	C.C.—orange	.300	.99	FND359	C.C.	.357	.75
MAN 4610	C.A.—orange	.400	.99	FND503	C.C. (FND500)	.500	.99
MAN 6610	C.A.—orange—DD	.560	.99	FND507	C.A. (FND510)	.500	.99
MAN 6630	C.A.—orange ± 1	.560	.99	HDSP-3401	C.A.—red	.800	1.50
MAN 6640	C.C.—orange—DD	.560	.99	HDSP-3403	C.C.—red	.800	1.50
MAN 6650	C.C.—orange ± 1	.560	.99	5082-7751	C.A., R.H.D.—red	.430	1.25
MAN 6660	C.A.—orange	.560	.99	5082-7760	C.C., R.H.D.—red	.430	1.75
MAN 6710	C.A.—red—DD	.560	.99	5082-7300	4x7 sgl. dig. RHD	.600	22.00
MAN 6750	C.C.—red ± 1	.560	.99	5082-7302	4x7 sgl. dig. LHD	.600	22.00
MAN 6780	C.C.—red	.560	.99	5082-7304	Overnge. char. (±1)	.600	19.95
DLO304	C.C.—orange	.300	1.25	4N28	Photo Xsistor Opto-Isol.		.99
DLO307	C.A.—orange	.300	1.25	LIT-1	Photo Xsistor Opto-Isol.		.69
DLG500	C.C.—green	.500	1.25	MOC3010	Optically Isol. Triac Driver		1.25

SOCKETS — Test TEXTOOL Sockets — RECEPTACLES



ZERO INSERTION FORCE

SOCKETS:
- ★ Nickel Boron Plating
- ★ G.F. PSF Plastic Body
- ★ For testing IC's

RECEPTACLES:
- ★ Nickel Boron Plating
- ★ G.F. PSF Plastic Body
- ★ Wire Wrap Contacts

Part No.	Pins	Price	Part No.	Pins	Price
214-3339	14 pin	5.95	222-3343	22 pin	9.95
216-3340	16 pin	6.49	224-3344	24 pin	9.75
218-3341	18 pin	7.95	228-3345	28 pin	11.95
220-3342	20 pin	8.95	240-3346	40 pin	12.95

Part No.	Pins	Price	Part No.	Pins	Price
214-3592	14 pin	9.75	222-3596	22 pin	12.95
216-3593	16 pin	9.95	224-3597	24 pin	12.75
218-3594	18 pin	10.95	228-3598	28 pin	13.95
220-3595	20 pin	11.95	240-3599	40 pin	15.95

LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100
8 pin LP	.17	.16	.15
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.37	.36	.35
24 pin LP	.38	.37	.36
28 pin LP	.45	.44	.43
36 pin LP	.60	.59	.58
40 pin LP	.63	.62	.61

SOLDERTAIL STANDARD (TIN)

	1-24	25-49	50-100
14 pin ST	.27	.25	.24
16 pin ST	.30	.27	.25
18 pin ST	.35	.32	.30
24 pin ST	.49	.45	.42
28 pin ST	.99	.90	.81
36 pin ST	1.39	1.26	1.15
40 pin ST	1.59	1.45	1.30

SOLDERTAIL (GOLD) STANDARD

	1-24	25-49	50-100
8 pin SG	.39	.35	.31
14 pin SG	.49	.45	.41
16 pin SG	.54	.49	.44
18 pin SG	.59	.53	.48
24 pin SG	.79	.75	.69
28 pin SG	1.10	1.00	.90
36 pin SG	1.65	1.40	1.26
40 pin SG	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

	1-24	25-49	50-100
8 pin WW	.59	.54	.49
10 pin WW	.69	.63	.58
14 pin WW	.79	.73	.67
16 pin WW	.85	.77	.70
18 pin WW	.99	.90	.81
20 pin WW	1.19	1.08	.99
22 pin WW	1.49	1.35	1.23
24 pin WW	1.39	1.26	1.14
28 pin WW	1.69	1.53	1.38
36 pin WW	2.19	1.99	1.79
40 pin WW	2.29	2.09	1.89

1/4 WATT RESISTOR ASSORTMENTS – 5%

ASST. 1	5 ea.	10 Ohm / 27 Ohm	12 Ohm / 33 Ohm	15 Ohm / 39 Ohm	18 Ohm / 47 Ohm	22 Ohm / 56 Ohm	50 pcs.	$1.95
ASST. 2	5 ea.	68 Ohm / 180 Ohm	82 Ohm / 220 Ohm	100 Ohm / 270 Ohm	120 Ohm / 330 Ohm	150 Ohm / 390 Ohm	50 pcs.	$1.95
ASST. 3	5 ea.	470 Ohm / 1.2K	560 Ohm / 1.5K	680 Ohm / 1.8K	820 Ohm / 2.2K	1K / 2.7K	50 pcs.	$1.95
ASST. 4	5 ea.	3.3K / 8.2K	3.9K / 10K	4.7K / 12K	5.6K / 15K	6.8K / 18K	50 pcs.	$1.95
ASST. 5	5 ea.	22K / 56K	27K / 68K	33K / 82K	39K / 100K	47K / 120K	50 pcs.	$1.95
ASST. 6	5 ea.	150K / 390K	180K / 470K	220K / 560K	270K / 680K	330K / 820K	50 pcs.	$1.95
ASST. 7	5 ea.	1M / 2.7M	1.2M / 3.3M	1.5M / 3.9M	1.8M / 4.7M	2.2M / 5.6M	50 pcs.	$1.95
ASST. 8R	Includes Resistor Assts. 1-7 (350 pcs.)							$10.95 ea.

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7/81 PRICES SUBJECT TO CHANGE

INTERSIL

Part No.	Function	Price
7045IPI	CMOS Precision Timer	14.95
7045EV/Kit*	Stopwatch Chip, XTL	22.95
7106CPL	3½ Digit A/D (LCD Drive)	16.95
7106EV/Kit*	IC, Circuit Board, Display	34.95
7107CPL	3½ Digit A/D (LED Drive)	15.95
7107EV/Kit*	IC, Circuit Board, Display	28.95
7116CPL	3½ Digit A/D LCD Dis. HLD.	18.95
7117CPL	3½ Digit A/D LED Dis. HLD.	17.95
7201IDR	Low Battery Volt Indicator	2.25
7205IPG	CMOS LED Stopwatch/Timer	12.95
7205EV/Kit*	Stopwatch Chip, XTL	19.95
7206CJPE	Tone Generator	5.15
7206CEV/Kit*	Tone Generator Chip, XTL	9.95
7207AIPD	Oscillator Controller	6.50
7207AEV/Kit*	Freq. Counter Chip, XTL	11.10
7208IPI	Seven Decade Counter	17.95
7209IPA	Clock Generator	3.95
7215IPG	4 Func. CMOS Stopwatch CKT	13.95
7215EV/Kit*	4 Func. Stopwatch Chip, XTL	19.95
7216AIJI	8-Digit Univ. Counter C.A.	32.00
7216CIJI	8-Digit Freq. Counter C.A.	26.95
7216DIPI	8-Digit Freq. Counter C.C.	21.95
7217IJI	4-Digit LED Up/Down Counter	12.95
7218CIJI	8-Digit Univ. LED Drive	10.95
7224IPL	LCD 4½ Digit Up Counter DRI	11.25
7226AIJL	8-Digit Univ. Counter	31.95
7226AEV/Kit*	5 Function Counter Chip, XTL	74.95
7240IJE	CMOS Bin Prog. Timer/Counter	4.95
7242IJA	CMOS Divide-by-256 RC Timer	2.05
7250IJE	CMOS BCD Prog. Timer/Counter	6.00
7260IJE	CMOS BCD Prog. Timer/Counter	5.25
7555IPA	CMOS 555 Timer (8 pin)	1.45
7556IPD	CMOS 556 Timer (14 pin)	2.20
7611BCPA	CMOS Op Amp Comparator 5MV	2.25
7612BCPA	CMOS Op Amp Ext. Cmvr. 5MV	2.95
7621BCPA	CMOS Dual Op Amp Comp. 5MV	3.95
7631CCPE	CMOS Tri Op Amp Comp. 10MV	5.35
7641CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7642CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7660CPA	Voltage Converter	2.95
8038CCPD	Waveform Generator	4.95
8048CCPE	Monolithic Logarithmic Amp	21.60
8069CCQ	50ppm Band—GAP Volt Ref. Diode	2.50
8211CPA	Volt Ref/Indicator	2.50
8212CPA	Volt Ref/Indicator	2.50

74C

74C00	.39			74C195	1.59
74C02	.39			74C221	1.95
74C04	.39			74C240	2.25
74C08	.39	74C106	.75	74C244	2.25
74C10	.39	74C107	1.89	74C373	2.49
74C14	.75	74C151	2.95	74C374	2.59
74C20	.39	74C154	3.95	74C901	.89
74C30	.39	74C157	2.25	74C903	1.15
74C42	1.39	74C160	1.69	74C911	10.95
74C48	1.95	74C161	1.60	74C912	10.95
74C73	.79	74C162	1.49	74C915	1.69
74C74	.79	74C163	1.69	74C917	10.95
74C85	1.95	74C164	1.59	74C922	5.49
74C86	.99	74C173	1.39	74C923	5.75
74C89	6.95	74C174	1.39	74C925	7.50
74C90	1.29	74C175	1.39	74C926	7.50
74C93	1.29	74C192	1.69	80C95	.79
74C95	1.59	74C193	1.69	80C97	.79

LINEAR

LH0002CN	6.85			LM702H	.79
LM10CLH	4.50			LM703CN	.89
LM11CLH	4.75	LM340T-5	1.25	LM709N	.49
LH0070-OH	6.05	LM340T-12	1.25	LM710N	.79
TL071CP	.79	LM340T-15	1.25	LM711N	.79
TL072CP	1.39	LM341P-5	.75	LM723N	.69
TL074CN	2.49	LM341P-12	.75	LM733N/H	1.00
LH0082CD	35.80	LM341P-15	.75	LM739N	1.19
TL082CP	1.19	LM342P-5	.69	LM741CN	.35
TL084CN	2.19	LM342P-12	.69	MC1741SCG	3.00
LH0094CD	36.80	LM342P-15	.69	LM747N/H	.79
LM300H	.99	LM348N	1.25	LM748N/H	.59
LM301CN/H	.35	LM350K	5.75	LM1014N	2.75
LM302H	1.95	LF351N	.60	LM1310N	1.95
LM304H	1.95	LF353N	1.00	LM1458CN	.59
LM305H	.99	LF355N	1.10	LM1488N	1.25
LM307CN/H	.45	LF356N	1.10	LM1489N	1.25
LM308CN/H	1.00	LM358N	1.00	LM1496N	1.95
LM309H	1.95	LM359N	1.79	LM1556V	1.75
LM309K	1.25	LM370N	4.49	LM1800N	2.95
LM310CN	1.75	LM373N	3.25	LM1877N-9	3.25
LM311H/CN	.90	LM377N	2.95	LM1889N	3.20
LM312H	2.49	LM380N	1.25	LM1896N	1.75
LM317MP	1.15	LM381N	1.95	LM2002T	1.49
LM317T	1.75	LM382N	1.79	LM2877P	2.05
LM317K	3.95	LM384N	1.95	LM2878P	2.25
LM318CN/H	1.95	LM386N-3	1.29	LM2896P-1	2.25
LM319N	1.95	LM387N	1.45	LM3189N	2.95
LM320K-5	1.35	LM389N	1.35	LM3900N	.69
LM320K-12	1.35	LM392N	.69	LM3905CN	1.25
LM320K-15	1.35	LF398N	4.00	LM3909N	1.15
LM320T-5	1.25	LM399H	5.00	LM3914N	3.95
LM320T-12	1.25	TL494CN	4.49	LM3915N	3.95
LM320T-15	1.25	TL496CP	1.75	LM3916N	3.95
LM323K-5	5.95	NE510A	6.00	RC4136N	1.25
LM324N	.99	NE529A	4.95	RC4151NB	3.95
LM329DZ	.65	NE531H	3.95	RC4194TK	5.95
LM331N	3.95	NE536H	6.00	RC4195TK	5.49
LM334Z	1.30	NE540H	6.00	KB4428	4.25
LM335Z	1.40	NE544N	4.95	KB4429	5.95
LM336Z	1.75	NE550A	1.30	LM4500A	3.25
LM337T	1.95	NE555V	.39	ICL8038B	4.95
LM337MP	1.15	LM556N	.99	LM13080N	1.29
LM338K	6.95	NE564N	3.95	LM13600N	1.49
LM339N	.99	LM565N	1.25	75138N	1.95
LM340K-5	1.35	LM566CN	1.95	75450N	.89
LM340K-12	1.35	LM567V	1.25	75451CN	.39
LM340K-15	1.35	NE570N	4.95	75492	.89

CAPACITOR CORNER

50 VOLT CERAMIC DISC CAPACITORS

Value	1-9	10-99	100+	Value	1-9	10-99	100+
10 pf	.08	.06	.05	.001µF	.08	.06	.05
22 pf	.08	.06	.05	.0047µF	.08	.06	.05
47 pf	.08	.06	.05	.01µF	.08	.06	.05
100 pf	.08	.06	.05	.022µF	.09	.07	.06
220 pf	.08	.06	.05	.047µF	.09	.07	.06
470 pf	.08	.06	.05	.1µF	.15	.12	.10

100 VOLT MYLAR FILM CAPACITORS

.001mf	.12	.10	.07	.022mf	.13	.11	.08
.0022mf	.12	.10	.07	.047mf	.21	.17	.13
.0047mf	.12	.10	.07	.1mf	.27	.23	.17
,01mf	.12	.10	.07	.22mf	.33	.27	.22

+20% DIPPED TANTALUMS (Solid) CAPACITORS

.1/35V	.39	.34	.29	1.5/35V	.41	.37	.29
.15/35V	.39	.34	.29	2.2/35V	.51	.45	.34
.22/35V	.39	.34	.29	3.3/25V	.53	.47	.37
.33/35V	.39	.34	.29	4.7/25V	.63	.56	.45
.47/35V	.39	.34	.29	6.8/25V	.79	.69	.55
.68/35V	.39	.34	.29	15/25V	1.39	1.25	.95
1.0/35V	.39	.34	.29	22/6V	.79	.69	.55

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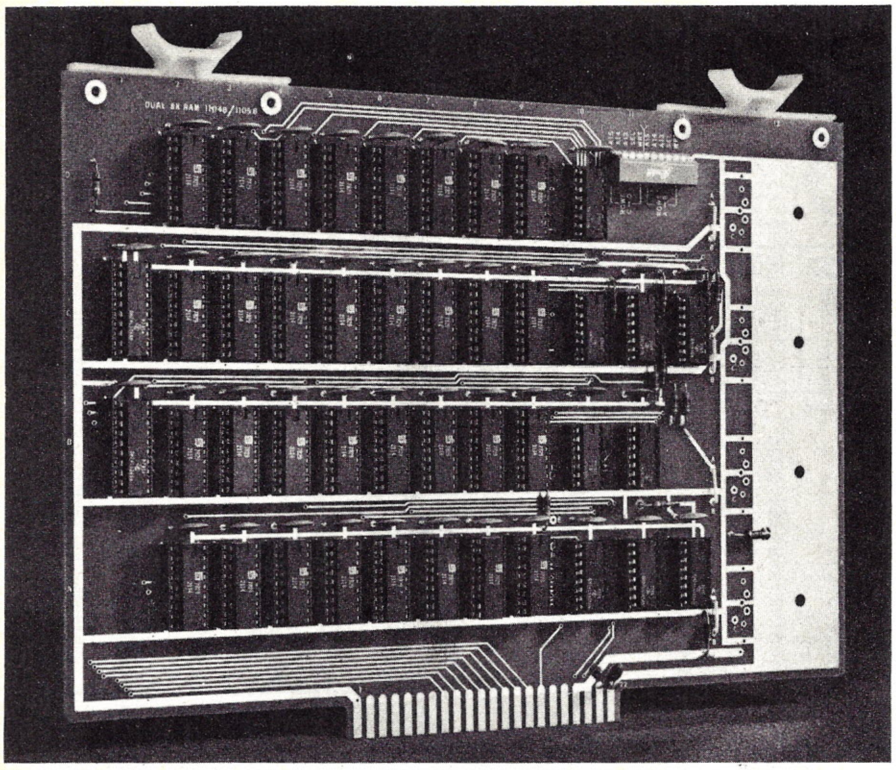
Axial	1-99	100-499	500+	Radial	1-99	100-499	500+
.47/50V	.16	.14	.10	.47/25V	.15	.13	.12
1.0/50V	.19	.16	.12	.47/50V	.16	.14	.13
3.3/50V	.17	.15	.11	1.0/16V	.15	.13	.12
4.7/25V	.18	.15	.11	1.0/25V	.16	.14	.13
10/25V	.18	.15	.11	1.0/50V	.17	.15	.14
10/50V	.19	.16	.12	4.7/16V	.15	.13	.12
22/25V	.19	.16	.12	4.7/25V	.16	.14	.13
22/50V	.24	.20	.18	4.7/50V	.17	.15	.14
47/25V	.25	.21	.19	10/16V	.15	.13	.12
47/50V	.29	.25	.23	10/25V	.16	.14	.13
100/25V	.28	.24	.22	10/50V	.17	.15	.14
100/50V	.41	.37	.34	47/50V	.25	.21	.19
220/25V	.39	.34	.33	100/16V	.21	.17	.14
220/50V	.49	.45	.41	100/25V	.25	.23	.21
470/25V	.54	.49	.45	100/50V	.37	.34	.31
1000/16V	.79	.69	.61	220/16V	.25	.21	.19
2200/16V	.89	.79	.69	470/25V	.35	.31	.27

✓See List of Advertisers on page 194

VAK-2 8K STATIC RAM BOARD
VAK-4 16K STATIC RAM BOARD



We also carry:
SYM-1 $229.00
AIM-65 w/1K $389.00
AIM-65 w/4K $439.00
We also do custom hardware and software for the 6502 microprocessor

SPECIAL PRICE:
VAK-4 $295.00
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Offer expires 7/30/81

PRICE:
VAK-4 ~~$325.00~~
VAK-2 $239.00
Add $4.50 for UPS
Shipment in continental U.S.
All others call or write for shipping charges

The VAK-2/4 was specifically designed for use with the KIM-1, SYM-1 and the AIM 65 Microcomputer Systems. The VAK-4, 16K Ram Board, consists of two (2) separate 8K blocks. Each block has it's own address, write protect and block enable switches.

The VAK-2, 8K Ram Board, is identical to the VAK-4 with sockets for all 16K of Ram, but it has only one of the 8K blocks populated with IC's. Therefore, the VAK-2 is user expandable to a full 16K with the purchase of the VAK-3 Expansion Kit.

Both the VAK-2 and the VAK-4 Boards are made with 1st quality, Industry Standard 450 *nsec.* 2114 RAM Chips. They plug directly into the VAK-1 Motherboard, or with addition of voltage regulators plug into the KIM-4* Motherboard.

SPECIFICATIONS:

- Completely assembled, tested and burned-in.
- All IC's are in sockets
- Fully buffered address and data bus
- Standard KIM-4* Bus (both electrical Pin-out and card size)
- Designed for use with a regulated Power Supply such as our VAK-EPS, but has provisions for adding regulators for use with an unregulated Power Supply.
- Each 8K Block Address is independent and switch selectable.
- Separate write-protect switch for each 8K block.
- Board size: 10 in. Wide x 7 in. High (including card-edge)
- Power requirements: VAK-2—5V.DC @ 1.2 AMPS.
  Power requirements: VAK-4—5V.DC @ 2.4 AMPS.

**KIM-4 is a product of MOS Technology/C.B.M.*

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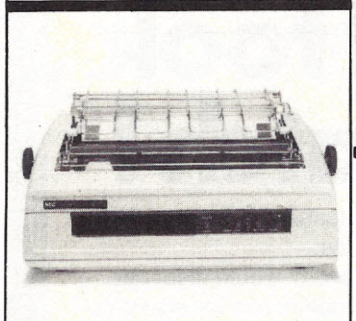
NEC SPINWRITER FROM THE FIRST NAME IN LETTER QUALITY PRINTERS/Compumart offers beautiful print quality with NEC Spinwriter Terminals. We carry all models from RO THRU KSR WITH NUMERIC KEYPAD—5510-5530. All versions give unsurpassed hard copy output! **CALL FOR PRICES**

NEW INTEGRAL DATA'S 560 PRINTER/All the exciting features of the 400 series plus 14 1/2" paper capacity. 132 col. graphics printer.
IDS 445. Priced lower than the 440 and equipped with a better print head. With & w/o graphics.
IDS 460. Features include correspondence quality printing, high resolution graphics.
CALL FOR PRICES



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OMNI 810 PRINTER FROM TEXAS INSTRUMENTS **CALL US**
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CLEARANCE ZENITH COLOR VIDEO MONITOR **$349.**

SUPER SELLING TERMINALS FROM LEAR SIGLER/We have the following Lear Siegler terminals in stock at prices too low to print! Call for quotes.
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IT IS HERE! It is the new Intermediate Terminal from Lear Siegler.
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CRISP LETTER QUALITY OUTPUT UNSURPASSED EASE OF OPERATION

This Compumart/Commodore system includes a **COMMODORE 8032 32K CPU,** a **4040 DUAL DISK,** a **C-ITOH PRINTER** and x/face and **WORD PRO 4 PLUS** (all cables included).
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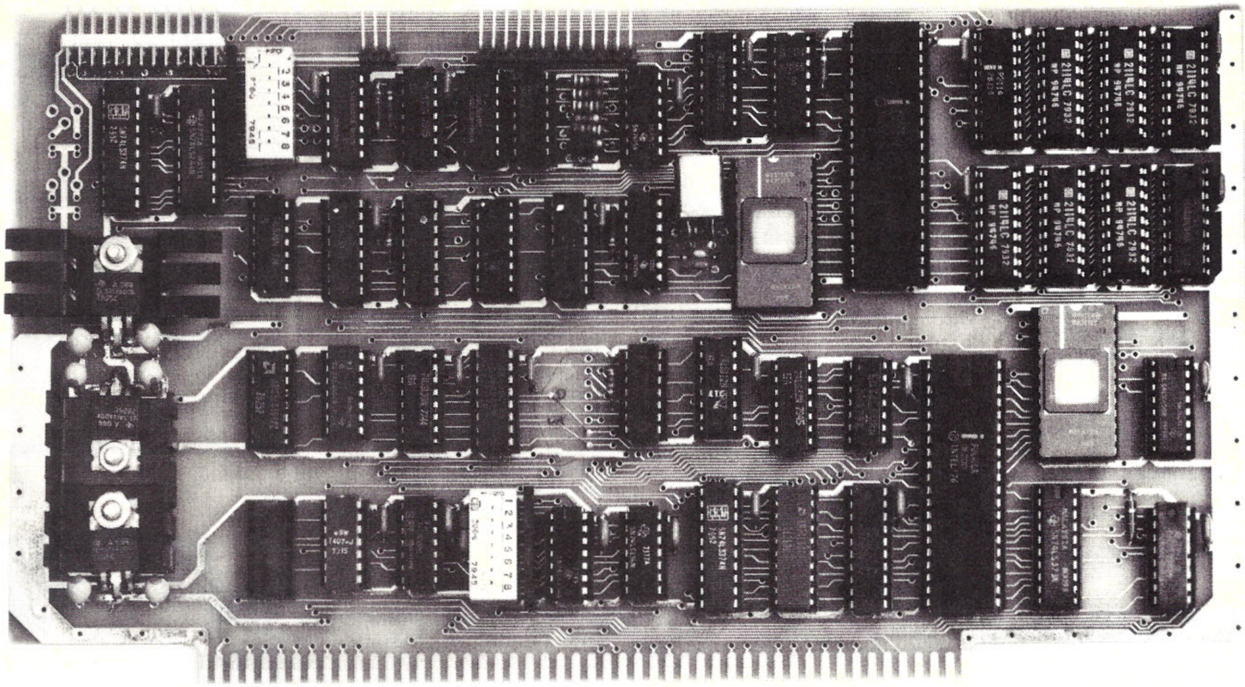
INTELLIGENT VIDEO I/O FOR S-100 BUS



VIO-X

The VIO-X I/O Interface for the S-100 bus provides features equal to most intelligent terminals both efficiently and economically. It allows the use of standard keyboards and CRT monitors in conjunction with existing hardware and software. It will operate with no additional overhead in S-100 systems regardless of processor or system speed.

Through the use of the Intel 8275 CRT controller with an onboard 8085 processor and 4k memory, the VIO-X interface operates independently of the host system and communicates via two ports. The screen display rate is effectively 80,000 baud.

The VIO-X1 provides an 80 character by 24 line format using a 7 × 9 dot matrix to display the full upper and lower case ASCII alphanumeric 96 printable character set (including true descenders) with special characters for escape and control characters. An optional 2732 character generator is available which allows an alternate 7 × 9 contiguous graphics character set.

The VIO-X2 offers an 80 character by 25 line format using a 9 × 9 dot matrix allowing high-resolution characters to be used. This model also includes expanded firmware for block mode editing.

Both models support a full set of control characters and escape sequences, including controls for video attributes, cursor location and positioning, cursor toggle, light pen location, and scroll speed.

Video attributes provided by the 8275 in the VIO-X include:

- FLASH CHARACTER
- INVERSE CHARACTER
- UNDERLINE CHARACTER or
- ALTERNATE CHARACTER SET
- DIM CHARACTER

The above functions may be toggled together or separately.

The board may be addressed at any port pair in the S-100 host system. Status and data ports may be swapped if necessary. Inputs are provided for parallel keyboard and for light pen as well as an output for audio signalling. The interrupt structure is completely compatible with Digital Research's MP/M

FEATURES

- HIGH SPEED OPERATION
- PORT MAPPED S-100 INTERFACE
- FORWARD/REVERSE SCROLL or
- PROTECTED SCREEN FIELDS
- CONVERSATIONAL or BLOCK MODE
- INTERRUPT OPERATION
- CUSTOM CHARACTER SET
- CONTROL CHARACTERS
- ESCAPE CHARACTER COMMANDS
- INTELLIGENT TERMINAL EMULATION
- TWO PAGE SCREEN MEMORY

VIO-X1 80 × 24 7 × 9 A & T **$295.00**
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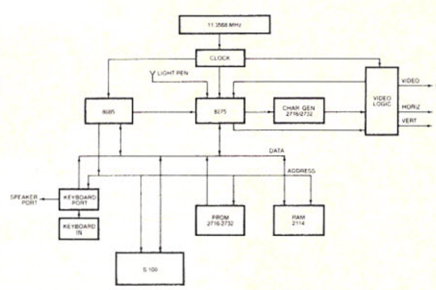
VIO-X2 80 × 25 9 × 9 A & T **$345.00**
Conversational & Block Modes



VIO-X S-100 I/O INTERFACE

285

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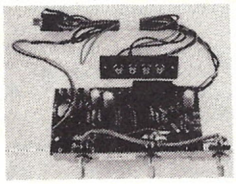

6⁵⁰

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Separate inputs for phono, radio, recorder, etc. Separate jack for head phones.
Replace your car stereo amp. Easy hook up — approximately 10 min. with our "how to" instructions.

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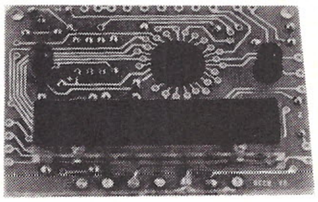
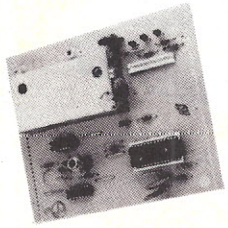


4⁰⁰ or 3 for 10⁵⁰

On board time base using popular MM5369. Operates on 12 Volt D.C. Display can be blanked.
Draws 30 MA-Display On. 13 MA - Display Off. Includes standard 3 x 4 Matrix control board (not shown). Module measures 2⅜ x 1¾. Extra bright magnified digits. Display contains 2 extra digits for custom applications (calendar, lap counter, or ?).

Video Game Board



4⁴⁵

3 for 12⁰⁰

Hockey • Tennis • Handball

- General Instruments AY3-8500
- Features Exciting Sounds
- On Screen Scoring
- Speed & Paddle Controls
- 1 or 2 Players
- Works on 8-15 Volts D.C.

Each board comes with RF Modulator (Ch. 3 or 4) and schematic. The only parts needed to complete game are speaker, 2-1 Meg Pots & Switches.

IC Specials!

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MC1310 - 1⁸⁰
LM3820 - A.M. Radio on a chip w/specs. 2/1⁰⁰

16 Pin Header

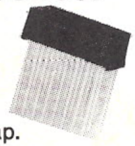
4/1⁰⁰

Power Transistor TO220 Case

3/1¹⁰

1 Amp 30 Watts 100 Volt
TIP 30C (PNP)
TIP 29C (NPN)

Gold Wire Wrap Sockets



Not Gold Inlay as Sold By Others.
Super 3 Level Gold Wire Wrap.

14 Pin - **10/3⁹⁵, 25/8⁷⁵**
16 Pin - **10/4⁹⁵, 25/11²⁵**

Video Paddle Controls

2 for 1⁰⁰

1 Meg
Can be used with game board above.

Voltage Regulator

LM309K

1⁰⁰

5 Volt - 1 Amp Regulator
TO3 Case. Super Special!

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3⁶⁵ or 3/9⁰⁰

Perfect for Computers, or anything that needs to be "glitch" free. By the #1 name in filtering, Sprague. JN17-5109B. Has I.E.C. Power Line Connector. 2x3 Amp. 115/220 VAC 60 Hz. 2⅛" x 2½" x 3" deep.

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- Non Canceling
- DPDT-PC or Solder
- Switches Easily Removed
- Push On/Push Off

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Telephone Accessories by Edwards

48 V
Loud

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IN4007

11/1⁰⁰

1000 Volts, 1 Amp
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Super High Input Impedance (10^{12} OHMS) — High Frequency Response. TO 4 MHZ. Large DC Voltage Gain 106 DB — New generation OP-AMP with Vastly Superior Features!

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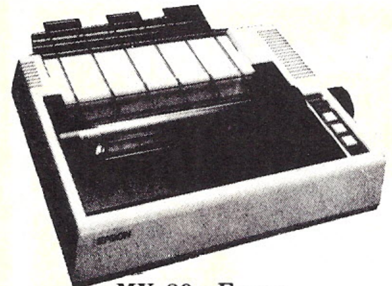

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132 column, 9 x 9 dot matrix, multiple fonts
PRM-27080 *Save $100.00* .... Call

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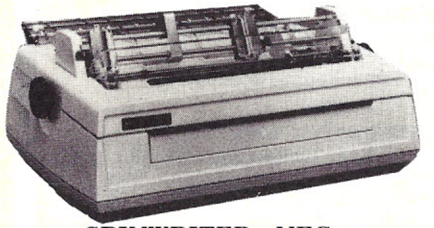
PRM-27070 With Graftrax II .... Call
Interface & Cable for Apple $110.00



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PRD-55511 *without 16K buffer* ... $2795.00
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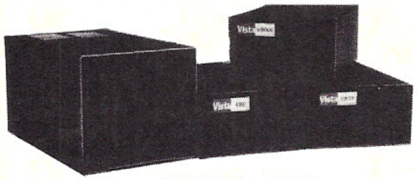

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Novation Cat Modem
300 baud, answer and originate

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The ultimate program for your Apple II
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5¼" disk drive with controller for your Apple
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8" DRIVES for APPLE
Controller, DOS, two 8" double densisty drives, cabinet, power supply, & cables
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13" COLOR MONITOR - Zenith
The hi res color you've been promising yourself
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20 MHz, P31 phosphor video monitor with audio, exceptionally high resolution - A fantastic monitor at a very reasonable price
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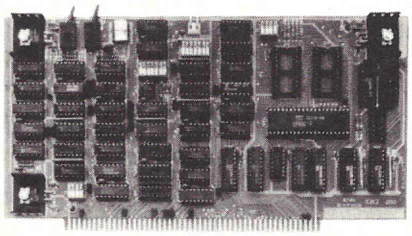
S-100 CPU



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2 or 4 MHz Z-80 CPU board with provision for up to 8K of ROM or 4K of RAM on board, extended addressing, IEEE S-100, front panel compatible.

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2 or 4 MHz switchable Z-80 CPU with serial I/O, accomodates 2708, 2716, or 2732 EPROM, baud rates from 75 to 9600*

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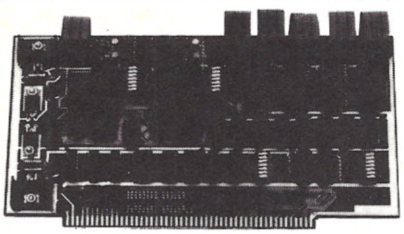
S-100 I/O



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IOI-1046K *4 CTC's, 2 SIO's, 1 PIO* **$259.00**
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MBS-121K *Kit* **$69.95**
MBS-121A *A & T* **$89.95**

18 Slot (14½" x 8⅝")

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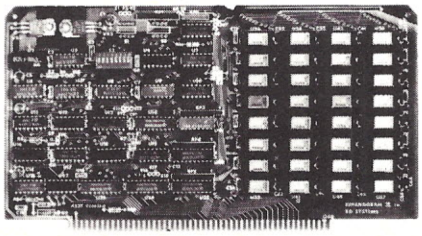
MBS-181K *Kit* **$99.95**
MBS-181A *A & T* **$139.95**

S-100 Memory



EXPANDORAM II - S D Systems

4 MHz RAM board expandable from 16K to 64K

MEM-16630K *16K kit* **$275.95**
MEM-32631K *32K kit* **$295.95**
MEM-48632K *48K kit* **$315.95**
MEM-64633K *64K kit* **$335.95**
Assembled & tested .... add **$50.00**

64K RAM - Calif Computer Sys

4 MHz bank port / bank byte selectable, extended addressing, 16K bank selectable, PHANTOM line allows memory overlay, 8080 / Z-80 / front panel compatible.

MEM-64565A *A & T* **$575.00**

MEMORY BANK - Jade

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MEM-99730B *Bare board* **$55.00**
MEM-99730K *Kit, no RAM* **$219.95**
MEM-16730K *16K kit* **$249.95**
MEM-32731K *32K kit* **$289.95**
MEM-48732K *48K kit* **$324.95**
MEM-64733K *64K kit* **$359.95**
Assembled & tested .... add **$50.00**

32K STATIC RAM - Jade

2 or 4 MHz expandable static RAM board uses 2114L's

MEM-16151K *16K 4 MHz kit* **$169.95**
MEM-32151K *32K 4 MHz kit* **$299.95**
Assembled & tested .... add **$50.00**

16K STATIC RAM - Cal Comp Sys

2 or 4 MHz 16K static RAM board, IEEE S-100, bank selectable, Phantom capability, addressable in 4K blocks

MEM-16160A *16K 2 MHz A & T* ... **$286.95**
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MEM-16160B *Bare board* **$50.00**

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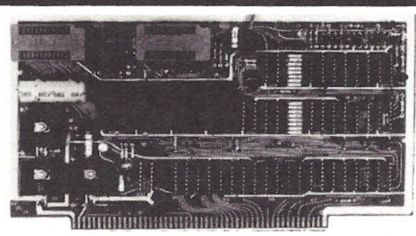


PB-1 - S.S.M.

2708, 2716 EPROM board with built-in programmer

MEM-99510K *Kit* **$139.95**
MEM-99510A *A & T* **$199.95**

PROM-100 - SD Systems

2708, 2716, 2732, 2758, & 2516 EPROM programmer

MEM-99520K *Kit* **$219.95**
MEM-99520A *Jade A & T* **$269.95**

EPROM BOARD - Jade

16K or 32K uses 2708's or 2716's, 1K boundary

MEM-16230K *Kit* **$79.95**
MEM-16230A *A & T* **$119.95**

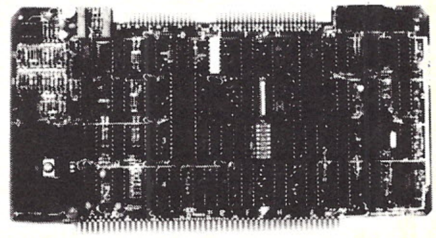
Mainframes

MAINFRAME - Cal Comp Sys

12 slot S-100 mainframe with 20 amp power supply

ENC-112106 A & T **$429.95**

S-100 Disk Controller



DOUBLE-D - Jade

Double density controller with the inside track, on-board Z-80A, printer port, IEEE S-100, can function on an interrupt driven buss*

IOD-1200K *Kit* **$299.95**
IOD-1200A *8" A & T* **$389.95**
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IOD-1200B *Bare board* **$65.00**

DOUBLE DENSITY - Cal Comp Sys

5¼" and 8" disk controller, single or double density, with on-board boot loader ROM, and free CP/M 2.2 and manual set.*

IOD-1300A *A & T* **$369.95**

VERSAFLOPPY II - SD Systems

New double density controller for both 8" & 5¼"

IOD-1160K *Kit* **$339.95**
IOD-1160A *A & T* **$379.95**

S-100 Video

VB-3 - S.S.M.

80 characters x 24 lines expandable to 80 x 48 for a full page of text, upper & lower case, 256 user defined symbols, 160 x 192 graphics matrix, memory mapped, has key board input.

IOV-1095K *4 MHz kit* **$345.00**
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IOV-1096K *80 x 48 upgrade* **$39.95**

VDB-8024 - SD Systems

80 x 24 I/O mapped video board with keyboard I/O, and on-board Z-80A.*

IOV-1020K *Kit* **$399.95**
IOV-1020A *Jade A & T* **$459.95**

VIDEO BOARD - Jade

64 characters x 16 lines, 7 x 9 dot matrix, full upper/lower case ASCII character set, numbers, symbols, and greek letters, normal/reverse/blinking video, S-100.

IOV-1050K *Kit* **$99.95**
IOV-1050A *A & T* **$125.00**
IOV-1050B *Bare board* **$29.95**

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*This advertiser prefers to be contacted directly.

LETTERS

(from page 32)

On Thursday, September 10, 1981, we will be devoting our "Media Network" program to the subject of home computers and how they can be of use to the active shortwave listener. As well as an introduction to microcomputing, we will also be including a short computer program in three different formats, broadcast in machine readable form over the air. Providing the signal strength is sufficient in the listener's area, we hope that it will be possible to record the computer program (off the air) onto cassette tape and play it back into a home computer. Preliminary experiments indicate that the system should work, but the purpose of the experiment is to gauge whether atmospheric noise is low enough in most of our target areas to enable the scheme to work. If successful, then the idea might be repeated on a more regular basis. Three computer programs, of use to the shortwave listener, and compatible with Tandy Radio Shack, Apple and Commodore PET microcomputers, will be transmitted.

We invite readers to tune in to our shortwave programs from Holland at the times and frequencies listed in Table 1. The program runs for 30 minutes. Listeners who hear the broadcast and try out the computer program are encouraged to write in and report their results to the following address:
Computer Experiment
Media Network
Radio Netherlands
PO Box 222
1200 JG Hilversum, Holland

J. Marks
Producer
Media Network
Hilversum, Holland

Greenwich Mean Time	Short-wave Frequency (kHz)	Target Area
07.47	9770, 9715	Australia
08.47	9715	Australia
09.47	15560, 11930, 9895, 6045, 5955	Europe
13.50	17605, 11930, 9895, 6045, 5955	Europe
14.47	11735, 15560, 21480	Southeast Asia
18.47	15220, 6020	East Africa
20.47	21685, 17695, 17605, 15220, 9715	West and central Africa (frequencies also audible in Europe)
02.47*	9590, 6165	Eastern North America
05.47*	9715, 6165	Western North America

*Note, this and the next transmission are shown as early Friday morning GMT, but it is still Thursday evening in the target area.

Table 1.

Better Red than Dead?

Your paragraph on Phyllis Schlafly ("Micro-Scope," April 1981) exemplified a decades-long characteristic of this culture (denouement imminent): what this culture scorns most is to think beyond the immediate moment to avoid national suicide.

Daniel M. Howard
Oakland, CA

Souped-up TRS-80

While thumbing through some back issues of *Kilobaud Microcomputing*, I came across Ronald W. Cowart's excellent article, "More TRS-80 Horsepower—Adding Level III BASIC" (October 1979). I read with interest the third section of the article, "Modifications for Level III BASIC." Since I own one of the "early model" TRS-80s which contain two Level I ROMs, I was rather disappointed to discover I couldn't add Level III because the modification was for the "later models" containing only one Level I ROM. With much apprehension, I decided to improvise.

I followed the directions exactly as they were presented in the article with several exceptions:

1. I connected contact 5 of the switch to Z34-20, not Z33-20. (See Fig. 2, p. 75.)
2. I connected contact 4 of the switch to the feedthrough just below the cut for the trace at Z34-20, not Z74-9. (See Fig. 2, p. 75.)

By making a "piggy back" chip out of ROM a and ROM b, I was able to bypass my obstacle of having two Level I ROMs instead of only one. Caution: Be sure to secure the bottom ROM in several layers of aluminum foil before soldering, since this acts as a heat sink, preventing damage to the chips. Plug the "piggy back" Level I ROM into socket Z34, double-check all connections and mount the switch as shown. Voila—Level III.

Although I don't use Level I very often, it's still nice to know it's there whenever I have the urge to "return to the grass roots."

Bob Wesley
Plattsburgh, NY

IDS Update

Several changes of interest have taken place since my article, "A Tale of Two Screen Dumps" (April 1981, p. 174), was written. Integral Data Systems (IDS) recently stopped manufacture of the Model 440 printer and replaced it with the less expensive 445. It is totally compatible with the older 440, since most of the changes involve a new head, ribbon and head drive motor. IDS also began shipment of the new 460 and 560 printers. They are definitely not compatible software-wise with the screen dumps described. Computer Stations, however, is now delivering another software package identical to the enhanced version to drive the 460 and 560 printers. I have personally used this package on the 460 printer and found it to perform identically with the 440 version. (The 560 printer is essentially a "stretch" version of the 460 and will take wider paper. It is otherwise identical with the 460 printer.)

There is, however, a tremendous difference in the graphic output quality. The 460 printer can truly make a white piece of paper black, and leave white dots for the graphic output. (See Example 1.) Also, the image printed by the 460 will have the correct aspect ratio (i.e., circles on the Apple screen will be printed as circles on the 460).

Computer Stations has advised me that they now offer a similar package for use with Pascal (Pascal Tigergraphics) and either the 440/445 or 460/560 printers. I haven't used either of these packages, and merely make note of their availability for those of you with interest in Pascal.

Jim Hansen
Lebanon, NH

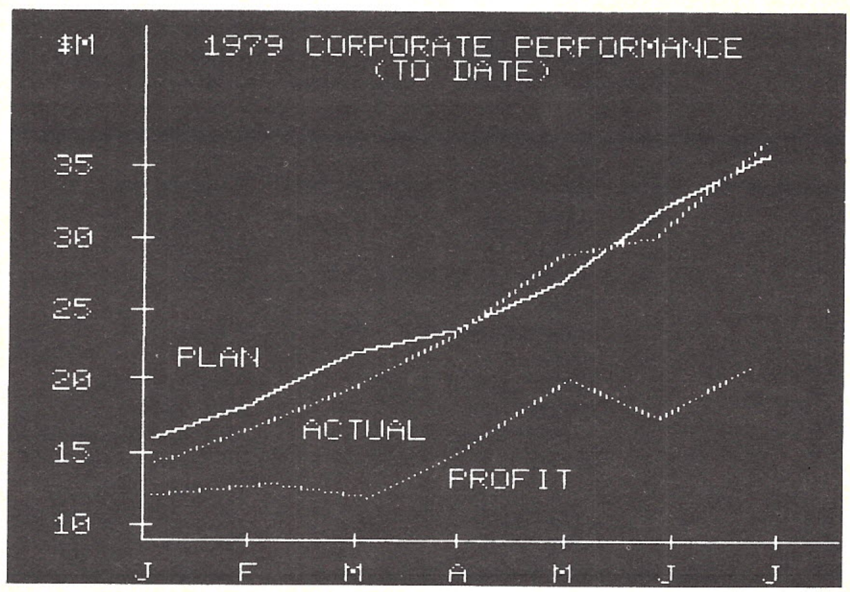
Dynamic Software for MSI

I have been using Software Dynamics software exclusively for the past several years on my Midwest Scientific Instruments computer and would like to share with your readers the many benefits available from the system.

SDBASIC Version 1.4 has been optimized for use with SDOS, SD's proprietary operating system, which is available for many 68xx-based machines. As such it is about one-third faster than previous versions, and programs are more compact. However, five unique features warrant its consideration over any other higher-level language currently available: the use of long variable names, labels to replace line numbers, subroutines and multi-line user definitions similar to FORTRAN and Pascal, unusually powerful string-handling capabilities and jump table access to the run-time-package floating point routines. While many languages offer one or more of these features, I know of none available for microcomputers which offers all.

The total SD package is also unique in many respects. Two editors (line and screen), an assembler and several application programs all designed to work with SDOS are available. Expected in the next few months are a relocating assembler and linker, which will support the powerful potential of the externally defined subroutine and user definition capabilities.

SDOS itself has features which will be



Example 1. Print sample on the enhanced package disk printed on the 460 printer in the "picture" mode to show how the printer can print a solid black background leaving white graphics.

much appreciated by anyone who has tried to modify an operating system in a unique way. It consists of three parts. The main part, SDOS proper, cannot easily be manipulated, but there is no real need to do so because its function is to interpret system calls and handle system architecture such as disk device and file drivers unique to SDOS. Because of this, however, the interface between the hardware and SDOS, the I/O package, is available to the user in source code form to add, delete or modify devices as he sees fit. The third part, the command interpreter, is written primarily in BASIC. This means any command you want to add or modify can be written in BASIC, although the user retains the option to use assembly language as well. For example, the standard FILES command does not have a date search routine. I added a BEFORE, AFTER and FOR <date> extension in a couple of hours, entirely in BASIC.

Robert B. Peirce
McMurray, PA

It's Not in the Stars

I wish to protest the inclusion of the article "Astrology and the Microcomputer" (p. 124) in your March 1981 issue. I think the inclusion of an article on such a dubious subject has no place in a serious publication.

I have no desire to give any refutation of astrology. Organizations such as the American Association for the Advancement of Science's Committee for the Investigation of the Paranormal have done a more complete job than I could present here, including a disconfirmation of Gauquelin's supposed correlations.

What I consider more important is the editorial policy of your journal. I do not understand how anyone involved in such a rational subject as computing could, with integrity, publish an article on such antiscientific subjects as astrology. Superstition has no place in serious journals.

H. Seyward
Scarborough, Ontario

Response:

The reference Mr. Seywerd makes is to the committee which published "The Zetetic." The statistical approach used was not always flawless, and further, a number of the "hypotheses" tested had nothing in common with astrology as practiced. (For a refutation of one example of the statistics as published, see Guy le Clercq, "CAO Times" 3(4), 1977.)

As a member in good standing of the American Association for the Advancement of Science and the New York Academy of Sciences, my evaluation of the work of the "scientists" who have chosen to attack astrology is that their knowledge of astrology is too superficial for them to be able to say anything intelligent on the subject. I did not claim in my article, nor do I believe, that astrology is a science; it lacks any paradigm system. Hence, it is inappropriate to label it antiscientific; more properly, it is nonscientific. However, I do find it interesting that Mr. Seyward's letter is loaded with emotionalism, albeit disguised by appropriate invective ("rational"? "dubious"? "serious"?), which would seemingly be inadmissible in a truly scientific discussion.

Dr. J. Lee Lehman
New York, NY

Computer Use Down Under

Since writing my article, "The Micro Down Under" (February 1981, p. 69), I have learned of the good work of the Angle Park Computing Center in Adelaide, South Australia, in promoting the use of computers in schools in that state and in the adjacent Northern Territory. Although sparsely populated, these two regions cover a total area equal to one-third of the continental U.S. and serve 300 schools as far apart as Darwin and Mount Gambier—a distance further than Minneapolis to Houston.

The Angle Park Center operates a microcomputer loan system to more than 70 schools and offers over 100 educational packages. In 1980 they conducted courses at the Center for 9000 students and more than 1000 teachers.

Quite clearly the efforts of Australia's least densely populated states, Tasmania, West Australia and South Australia (plus the Northern Territory), put the remaining states of Australia to shame in the use of computers in schools.

Right now a fierce argument is raging in Australia on questions of literacy (particularly the lack of it) among our school leavers. I believe that this skill is assisted by exposure to computing in schools, especially if the computers are skillfully incorporated into remedial teaching. Therefore, I hope Australia's most populated states, New South Wales, Queensland and Victoria, will soon follow the lead of Tasmania and South Australia and give the micro its rightful place in their education systems.

Colin Keay
Newcastle, N.S.W., Australia

A Frank Assessment

I disagree strongly with Thomas Franks' review of William Barden's *How to Program Microcomputers* (January 1981, p. 241). It is an excellent book for a novice programmer. That book, together with TSC's well-commented source listings, taught me most of what I know about assembly-language programming—not a good subject to learn without a teacher, but I did it, thanks to Barden's book.

Tom Boyd
Surrey, England

Edited by Linda Stephenson

New Printers from Centronics and Dataroyal
Business Computer
PET Floppy Disk
Atari Memory Expansion

Graphics Printer

Centronics Data Computer Corp., Hudson, NH 03051, has announced its Model 739 printer. The new printer produces correspondence printing for text and data processing, plus graphics designed to meet the needs of the small-business-system user. Standard features include pin-addressable graphics with a resolution of 74 dots per inch horizontal by 72 dots per inch vertical, a monospaced print speed of 100 cps and an acoustical cover that provides improved single-sheet paper loading and reduces noise.

The Model 739 prints 7×8 dot matrix characters with true underline at 10 and 16.5 characters-per-inch for standard data processing tasks, and generates N×9 dot matrix proportional characters with true descenders for text editing applications. The printer creates subscripts and superscripts by performing forward and reverse half-line steps under manual or software control. It accepts 8-1/2×11 inch cut sheet, 9 inch pin-to-pin fan-fold and roll paper to 8-1/2 inches wide. Model 739 serial versions include a standard 2K buffer suitable for screen dump applications.

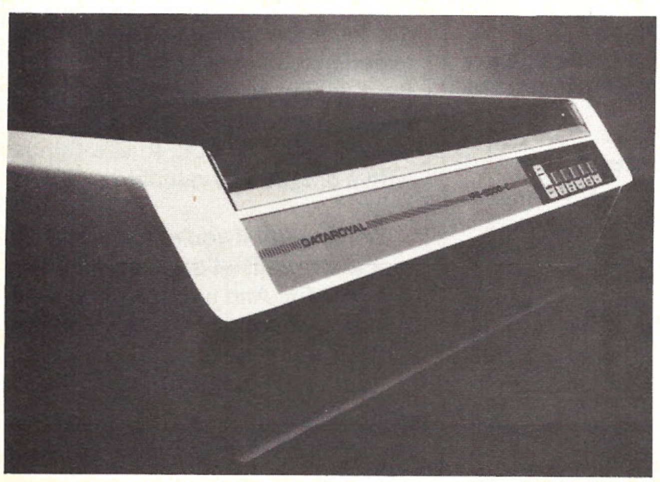
The new printer is priced under $1000. Reader service number 470.

Centronics Model 739 printer.

Intelligent Matrix Printer

The IPS-5000-C intelligent dot-matrix printer offers increased programmable memory, graphics, international character sets, print-style selection and other features to handle complex printing applications and communications protocol. Thanks to its open-ended direct-memory-access architecture, the IPS-5000-C printer has the potential for unlimited memory expansion. The standard IPS-5000-C contains up to 12K of EPROM and 4K of RAM. The 80-column printer costs $1510; 130-column unit is $1695.

Dataroyal, Inc., 235 Main Dunstable Road., Nashua, NH 03060. Reader service number 480.



Dataroyal's new IPS-5000-C high-capacity printer.

Versatile Business Computer

The Expander S-100 computer is built around a single board that contains a Z-80A CPU, keyboard circuitry, interrupt, video circuitry, real-time clock, parallel printer interface, RS-232 serial interface and full color circuitry. It requires a video display and media storage for operation. Features include standard 80×24 screen format, upper/lowercase, 4K ROM monitor, 64K RAM (expandable to 512K), video output and color graphics using 256 colors and a complex tone generator with internal speaker. Keyboard capabilities include calculator keypad, two programmable function keys and four cursor control keys.

The versatile Expander functions as a process control or monitoring system, as a data communications terminal or for other applications that do not require a video display. It has room for several S-100 boards, so the computer can be configured to perform word processing and high resolution color graphics. All CP/M and MP/M software written for the Z-80 will run on the Expander. It is sold with 24K Microsoft BASIC-80 (disk version) and 10K Microsoft BASIC-80 (cassette tape version). Price is $2200.

Micro-Expander, Inc., 6835

The Expander from Micro-Expander, Inc.

W. Higgins Ave., Chicago, IL 60656. Reader Service number 468.

Floppy-Disk System for PET

PEDISK II is a low-cost, high-performance floppy-disk system for the Commodore PET. It is available with 5-1/4-inch or eight-inch disk drives. A small disk controller board mounts inside the machine and contains the PDOS software ROM and all the disk control circuitry. One, two or three drives connect to the PEDISK II controller board, providing a fast mass-storage system for the 2000, 4000 or 8000 series PET. PEDISK II is compatible with all Commodore disk systems, and both can be used simultaneously in the same machine. With appropriate software, files can be transferred from one disk system to the other. The eight-inch PEDISK II system can exchange diskettes with large computers. The PDOS software links the resident BASIC to the disk system by adding a new repertoire of disk commands.

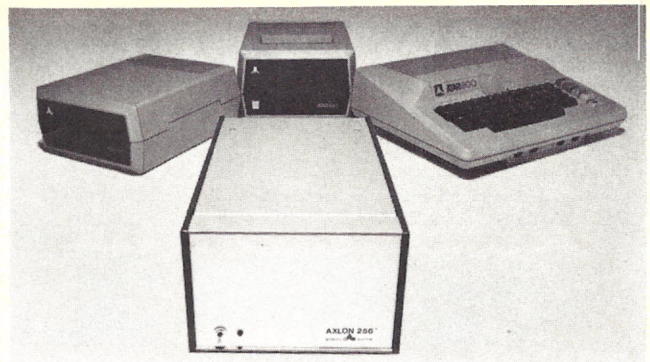
The 143K single-drive 5-1/4-inch system sells for $595; the 572K dual-drive quad-density system is priced at $1195.

CGRS Microtech, Inc., PO Box 102, Langhorne, PA 19047. Reader service number 476.

Atari Memory System

The Axlon 256 memory system increases storage capacity of the Atari 800 computer from 48K of random access memory up to 256K, providing a 500 percent expansion of the RAM memory currently available in the Atari system. The new Axlon product functions as a very fast disk. When compared with the Atari 800 disk drive, the Axlon system improves disk transfer time from 756 bytes per second to 128,000 bytes

PEDISK II floppy-disk system from CGRS Microtech, Inc.


Axlon 256 memory expansion system for the Atari 800.

per second. The 256 system is plug-in compatible with the Atari 800. Installation is accomplished by inserting the system interface card into the second RAM slot in the 800, and the PIA control cable into the Atari control jack. All interface hardware is included with the system and no modifications are required. Axlon also includes a modified DOS with the system.

The system comes with two 32K RAMCRAM modules. Additional modules can be added until the full 256K capacity is achieved. Atari RAM modules can also be used in the Axlon system. The standard system, with 64K of RAM, is $895.

Axlon, Inc., 170 N. Wolfe Road, Sunnyvale, CA 94086. Reader service number 473.

Six-Megabyte Hard-Disk Micro

The smallest and most inexpensive Onyx microcomputer ever, featuring a 5-1/4-inch Winchester hard disk with a capacity of 6M, is now being offered by Onyx Distribution, Inc., 315 South Ellis, Wichita, KS 67211. The Onyx C5000 has a high-speed Z-80 processor and high-density cartridge tape backup. It is compatible with COBOL, Pascal and FORTRAN. The C5000 provides an alternative to floppy-disk systems for small businesses, and is priced at $9500. Reader service number 475.

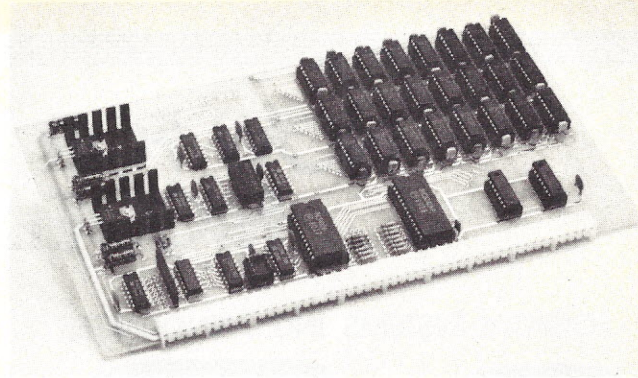
RAM Expansion System

A dynamic RAM card for System-50 (SS-50 bus) 680X computers is now offered by Percom Data Company, 211 N. Kirby, Garland, TX 75042. The M48DSS can be strapped to reside in any of the 64K banks of a 1M memory space. Operating power for a fully populated card—48K of RAM—is only 5 W maximum.

It features block organization, with RAM ICs organized as three independent 16K blocks. Any block can be mapped into any of the four 16K zones of a 64K address space. On-card circuitry permits deselection of any 8K block from the upper 32K address space. M48DSS cards


The C5000 microcomputer from Onyx Distribution, Inc.

✓See List of Advertisers on page 194



Percom Data's 48K dynamic RAM card.

are fully tested and burned in. The user's manual includes application instructions, schematics and other drawings, plus assembly-language listings of 6800 and 6809 diagnostic memory test programs.

Prices are $499.95 for 16K, $599.95 for 32K and $699.95 for the 48K card. Reader service number 472.

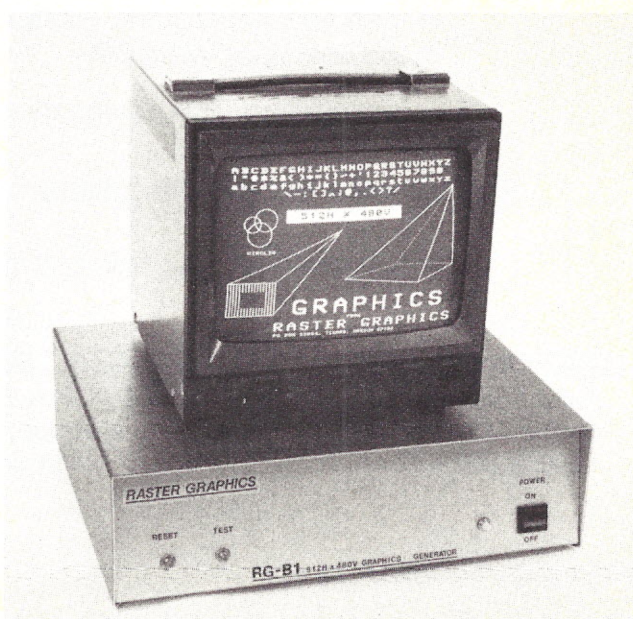
Graphics and Text for Host Computers

The RG-B1 512H×480V Graphics Generator adds graphics capability to any computer via its RS-232 port. The RG-B1 is a smart, standalone graphics generator that accepts high level commands from a host computer and displays text and graphics on a standard 525-line TV monitor. Graphics capability includes point-to-point drawing, circles, reverse video, variable-sized ASCII characters, selective erase and rectangular fill. Unit price is $1450.

Raster Graphics, PO Box 23334, Tigard, OR 97223. Reader service number 479.

Direct-Connect Modem for Apple II

A direct-connect telephone modem for use with Apple II and Apple II Plus microcomputers has been introduced by ESI Lynx, 123 Locust St., Lancaster, PA 17602. It plugs into Apple's peripheral slots and the telephone line; no acoustic coupler is used. Its case is styled to match the Apple II. Standard features include originate/answer, programmable word length, parity, number of stop bits and full/half duplex. Auto-dial and auto-answer are extra. The



RG-B1 graphics generator from Raster Graphics.

ESI Lynx direct-connect modem.

Lynx package contains all needed hardware and software, plus an instruction manual that lists free bulletin-board telephone numbers and describes how to call these and other services, including The Source and CompuServe. Price is $289.95. Reader service number 467.

Low-Cost Printer

Microtek, Inc., 9514 Chesapeake Drive, San Diego, CA 92123, announces a new low-cost 80-column dot matrix printer. The Bytewriter-1 accepts single sheet or roll paper up to 8-1/2 inches wide, and prints at 60 lines per minute using a 7×7 dot matrix. The Bytewriter-1 interface is similar but not identical to a Centronics parallel interface, and has been designed to operate with the Apple II, Atari 400/800 and all models of the TRS-80. The print mechanism and logic board are designed and manufactured in the U.S. Price is $299. Reader service number 465.

Portable RS-232 Memory System

Braemar Computer Devices, Inc., 11950 12th Ave., S., Burnsville, MN 55337, is now offering the MTL 900 portable mini-cassette system for remote data gathering, memory down-loading and remote program updating. This new memory system unit uses a Braemar mini-digital cassette read/write unit with RS-232 interfacing. The necessary cable and connector assembly is included. Each miniature cassette holds up to 86K at 800 bpi, and the sys-

Bytewriter-1 from Microtek, Inc.

✓See List of Advertisers on page 194

Braemar's portable MTL 900 mini-cassette system.

tem has a data transfer rate of 2400 baud. Power is normally supplied through the interface cable from the host equipment. Internal ac or battery power supplies are optional. The MTL 900 is priced at $425. Reader service number 471.

Surge Control

A new power surge control unit, designed for use with existing 120 V terminal (multiple outlet) strips, has been introduced by RKS Enterprises, Inc., 643 South 6th St., San Jose, CA 95112. The Surge Sentry Model SS-120-P protects a number of small computers and data communications, medical or other microprocessor-controlled equipment from destructive voltage transients. It plugs into any one of the outlets on an existing terminal strip, providing continuous surge protection through each of the other outlets on that strip. The Model SS-120-P detects and shunts all unwanted or potentially dangerous voltage transients in picoseconds. Price is $69.50. Reader service number 482.

One Megabyte 8/16-Bit Development System

Syst/M Four is an 8085/8088 development system using 1M of static RAM in a single enclosure. The IEEE S-100 system takes advantage of a dual processor CPU card containing a 6-MHz 8085 and a 6-MHz 8088 to allow running either eight- or 16-bit software from a single disk, providing an ideal environment for upgrading eight-bit programs to 16 bits. Standard software includes CP/M 2.2 and CP/M 86 from Digital Research, eight- and 16-bit Pascal compilers from Sorcim, and Trans86 by Sorcim, which allows 8080 or Z-80 source to be translated into 8086 source. Standard hardware includes two double-density eight-inch floppy-disk drives and an eight-inch 10M hard disk. Two programmable interrupt controllers, a real-time clock/calendar with battery backup, three cascadable 16-bit interval timers and a 9511 math processor are also standard. Price is $19,950.

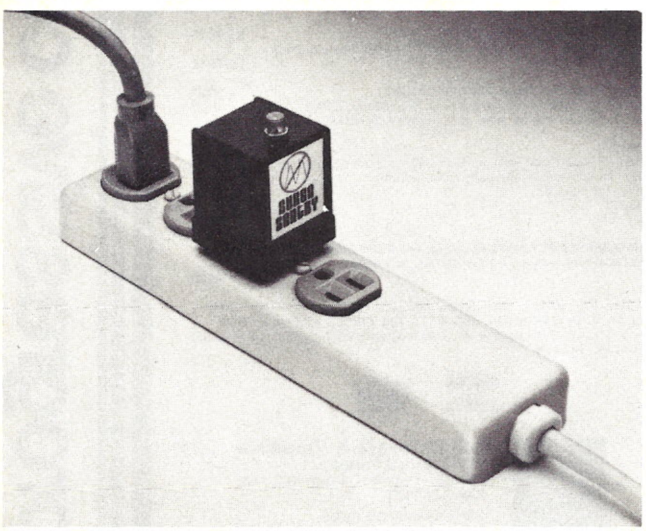
G & G Engineering, 2806 Marina Blvd., San Leandro, CA 94577. Reader service number 469.

Percussion Synthesizer

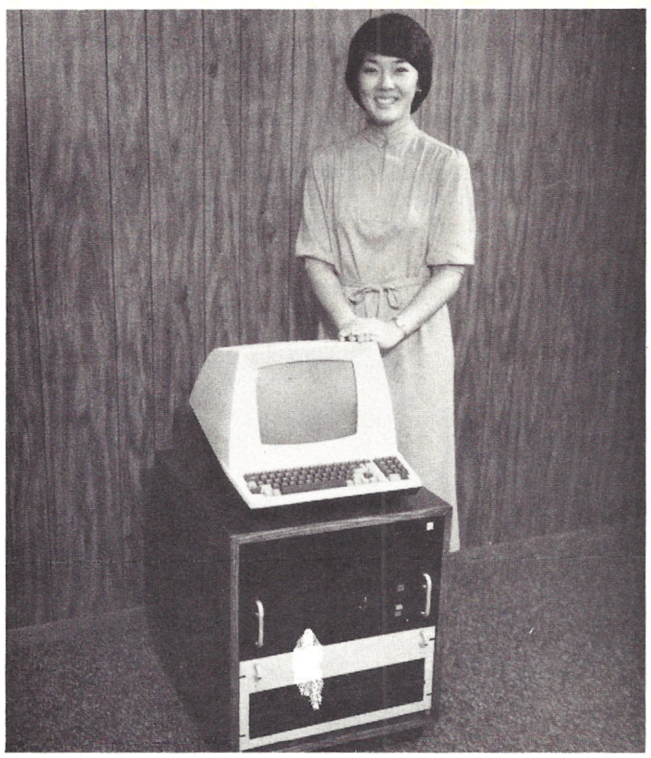
The Rhythm Box is a new computer peripheral that synthesizes the sounds of seven different percussion instruments—bass drum, wood block, snare drum, short cymbals, long cymbals, hand-clap and tom-tom. It is easy to program in Level II BASIC or assembly language; a single OUT instruction generates any combination of percussion sounds plus a loudness control for rhythmic emphasis. It was designed for game players, computer-music enthusiasts, music teachers and professional musicians who want to create anything from a simple, repetitive rhythmic pattern to a long, continuously varying percussion score. The Rhythm Box can be used alone or with other music peripherals, and a second unit can be added for stereo.

It comes with a phono jack for connection to your audio system, a UL listed power supply, 60-day warranty, user's manual including BASIC and assembly-language software examples, and a wide selection of rhythm charts for every rhythm from waltzes to rock. The Model RBX-S Rhythm Box connects to standard 9600 baud serial interface. Price is $182.

Newtech Computer Systems, Inc., 230 Clinton St., Brooklyn, NY 11201. Reader service number 474.



Surge Sentry from RKS Enterprises.



Lauren Kawakami, a part owner of G & G Engineering, with their Syst/M Four development system.

✓*See List of Advertisers on page 194*

CP/M Business Planner
Magic Typewriter
Hard Hat Accounting
Data Abstractions

Business Planning System

Target is a business planning system designed by Advanced Management Strategies, Inc. (AMSI), of Atlanta and now sold by Westico, 25 Van Zant St., Norwalk, CT 06855. Target users can quickly analyze past business activities and project likely future performances. User errors are easily corrected because Target can display or print the entire set of data entries, calculation rules and report specifications. Calculation commands are entered in English sentences. Target makes business planning easier by performing conditional tests on data calculations. It uses functions such as cumulative, minimum, maximum, greater of, lesser of and grow by, which are not found in many other systems. Target is a compiled system running under the CP/M operating system and is intended for use on the TRS-80 Model II, Intertec Superbrain, Zenith Z-89 and Vector System III. Other microcomputers using CP/M and with 56K memory and 200K disk storage can support Target. Price is $195. Reader service number 495.

Versatile Software System

Magic Typewriter version 2.2 provides word processing and database management in one program. As a word processor, it is simple to use: most commands are either single words or mnemonics. The user can move blocks of text, selectively load or delete, find material from disk files without disturbing the file in memory and swap character strings in one line, a block of lines or throughout the entire text, with a single command.

As a database management system, Magic Typewriter lets the user customize the system to his own needs. Records can be up to 200 characters, and output can be custom-formatted. The same address list, for instance, can be printed as a phone list or mailing labels, sorted by city, state, zip code, expiration date or any other criterion the user wants to specify. The system has an extremely rapid sort, and can scan either an entire record or specific fields within a record. A file can be scanned in a few seconds. The price is $175.

California Digital Engineering, Box 526, Hollywood, CA 90028. Reader service number 483.

Accounting Program for Construction Businesses

Charles Mann & Associates, Micro Software Division, 7594 San Remo Trail, Yucca Valley, CA 92284, has announced a new applications package for the construction industry. The Construction Accounting System, for Apple II, Apple II Plus and Apple III computers, is a full General Ledger, Payroll, Job Cost Accounting and Subcontractor Records system. The system also includes its own report preparation system which can be used to design special account reports, proposals, job bids and annual reports.

General Ledger allows the payment of job-related costs on a planned basis corresponding to work schedules or payment receipts. The Payroll system allows for monthly, bimonthly, biweekly or weekly payrolls, with automatic posting to the General Ledger and the Job Cost subsidiary accounts. Job Cost permits continuous inspection of each job's fiscal progress. Jobs can have a custom list of up to 99 expense classifications. The system prepares fiscal reports suitable for project management and lender reimbursement. The Subcontractor system creates subsidiary accounts. Reports easily locate jobs under contract with each subcontractor, change order amounts, payments-to-date by job and contract costs remaining. Posting to the system is automatic and annual preparation of IRS-required 1099 forms is simplified. Price is $359.95. Reader service number 492.

Data Abstraction Language

DATABS is a data abstraction language which runs under CP/M disk-operating systems, and is suitable for control and systems programming. The built-in types of DATABS are Boolean, character, single-byte integer, double-byte integer and string. Data abstractions allow the implementation of user-defined types using a dynamic storage mechanism. Data abstractions are a step beyond structured programming. Programs created using DATABS are easier to design, understand and modify. DATABS supports UNIX-style command line arguments and I/O redirection with < and >. A stream abstraction allows terminal and disk input/output. A system with at least 40K is required.

Package includes a CP/M-compatible disk containing the compiler, built-in type and run-time support library, stream abstraction and command line processor, along with a 73-page user's manual. The price is $49.50.

Softronics, 36 Homestead Lane, Roosevelt, NJ 08555. Reader service number 484.

Music and Animation

Rainbow Writer is a graphics, text, music and animation computer-program-development aid which runs on the Apple II and Apple II Plus. It uses simple commands and menu selections to create special effects featuring color, animation, letters, shapes and sounds. Rainbow Writer's large-scale graphics are particularly suitable for generat-

ing text and animation for educational applications, and its sound effects help to maintain a child's interest and participation in the program. Rainbow Writer creates animation by using two distinct areas of memory in the Apple that are used to produce images on the television monitor. Rainbow Writer rapidly shifts the image-making back and forth between the two areas to create the impression of movement.

Users can define their own character fonts, or choose among nine sizes and 18 different colors of upper/lowercase English and Greek letters. Musically, Rainbow Writer offers six chromatic octaves, and special tonal effects such as note sustain. Sequential notes can be stored on disk for playback as a tune on the Apple's internal speaker. The price is $39.95.

Personal Software, Inc., 1330 Bordeaux Drive, Sunnyvale, CA 94086. Reader service number 499.

Job Cost System Now in PL/1

Microcomputer Consultants, PO Box T, 1623-A 5th St., Davis, CA 95617, has completed conversion of its Job Cost Control and Analysis System (JCC) to PL/1-80. JCC is suitable for use in any job-oriented business. It allows the user to track and control expenditures of jobs in progress, and to monitor the profitability of each job. Potential cost overruns are identified early so that corrective action can be taken. JCC can be used to control the Jobs Accounts Receivable. It provides information on employee performance suitable for use in employee profit-sharing plans.

Software written in PL/1 offers several major advantages to end users. It is fast, reducing processing time. A PL/1 program is already compiled, and takes up less RAM than a similar program written in BASIC. All invalid entries are detected as soon as they are made, and the operator receives an easily-understood explanation of what went wrong. The new version of JCC utilizes the Micro B+ file-access routine from Faircom. Micro B+ provides fast file-access time, and eliminates the need to sort or reorganize files. JCC runs under the CP/M 2.2 operating system, and requires at least 56K of RAM. Eight-inch, single-sided, single-density diskette is $600. Reader service number 488.

Graphing Program for the Apple

Muse Software, 330 N. Charles St., Baltimore, MD 21201, is offering Data Plot for 48K Apple microcomputers with Applesoft in ROM. Easy-to-use menu-driven options provide a graphing tool that can be used immediately by anyone who needs to plot numerical information. The user's manual is written in a tutorial format, with step-by-step pictures that match actual sample data files contained on the program disk. Plot displays range from single line or bar charts to multiple line, additive bars, as well as mixed line and bar formats. Scatter diagrams and pie charts are easily created. Basic statistics are calculated for each display. Automatic and manual scaling and labeling are provided. The disk costs $59.95. Reader service number 491.

Database for Apple Literature

A rapid-retrieval database for the complete Apple literature through 1980 has been developed. Each entry in the database consists of the article title, author name, periodical name, date of issue and page numbers. A search program on the disk asks the user to input a word of interest, such as ROM or GRAPHICS. A search then begins through five years' accumulation of data on disk, and a list of entries is printed out on screen or printer. The product is intended for users with large numbers of magazine back issues who want to retrieve Apple articles quickly. Annual updates will be available. The price for the database on minifloppy diskette is $60. It requires 48K of RAM and Applesoft in ROM.

Connecticut Information

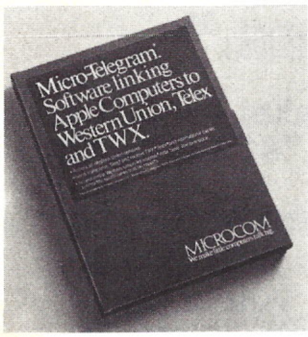
See List of Advertisers on page 194

Systems, 218 Huntington Road, Bridgeport, CT 06608. Reader service number 486.

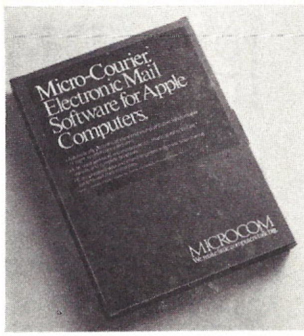
Apple Communications Packages

Two new communications programs are available from Microcom, Inc., 89 State St., Boston, MA 02109. Micro-Courier lets owners of Apple II microcomputers transmit charts, graphs, correspondence, VisiCalc reports and entire programs to other Apple computers over standard phone lines. These electronic mail transmissions can be sent automatically, allowing the owner to take advantage of low night phone rates. The program is menu-driven and simple to use.

Micro-Telegram is for any business that uses TWX, Telex and Mailgrams. It lets an Apple II computer access Western Union services worldwide. You can send Mailgrams, send and receive TWX, Telex and international cables, and receive Infomaster up-to-the-minute news, stock, foreign exchange, gold, futures, sports and ski reports. You can also edit messages on the screen and send them automatically. Micro-Courier and Micro-Telegram are each priced at $250. Reader service number 487.



The Micro-Telegram program from Microcom.



Micro-Courier package from Microcom.

Graphics Language for PET

A new interactive language for PET/CBM microcomputers is available from Abacus Software, PO Box 7211, Grand Rapids, MI 49510. Vigil (Video Interactive Game Interpretive Language) is an easy-to-learn graphics and game language that lets you quickly create interactive applications. Vigil features more than 60 commands to manipulate graphics figures on the screen, double-density graphics and access to two event timers. Vigil is available on cassette, and is ready to run on any 40-column PET/CBM with at least 8K of memory. The price is $35. Reader service number 498.

PET Program Printing

Program Printer provides PET users with formatting and printing of BASIC programs. It places each BASIC statement on a separate print line and inserts blanks to improve clarity. It also breaks lines of multiple BASIC statements onto separate print lines.

There are three versions of Program Printer available. One version is used to print to an IEEE device via the GPIB, and sells for $25. The version used to output to an RS-232 ASCII printer, at any rate from 50 to 4800 baud, is priced at $75. The Program Printer used with an IBM Selectric 2741 or COPE 1030 printer/terminal sells for $125. The Program Printer package includes a user's manual and floppy diskette, plus a backup diskette.

PhD Associates, Inc., 107 Fordwich Crescent, Rexdale, Ontario, M9W 2T6, Canada. Reader service number 489.

Phone Bill Analyzer

Long Distance Analyzer, a business program for disk-based TRS-80s, streamlines accounting for long-distance telephone costs. Calls are grouped and totalled by number to help you cost-account, bill clients and investigate unfamiliar numbers. Matching your bill with your file of recognized numbers, the program identifies where your calls go. Your usage patterns are analyzed by area code, state and WATS zone. The "recognized number" file prints out as a directory. Minimum requirements are 16K, Level II and one disk drive; printer is optional. Disk for Models I and III is $135. Model II disk is $155.

Program Printer from PhD Associates.

Golden Braid Software, PO Box 2934, Sarasota, FL 33578. Reader service number 490.

Disk Operating System

MuDOS is a CP/M-compatible operating system offering higher throughput, increased reliability and extra professional features for both single-user and multiple-user environments. MuDOS is ideal for use with the MuSYS Net/80 and EXP/80 network slave processors. The system may be customized to any Z-80 hardware configuration and used in place of CP/M, MP/M and CP/Net. Program loading under MuDOS is six times faster than CP/M. File processing functions average three to five times faster. MuDOS uses the extra registers and instructions available on the Z-80 to speed processing of operating system calls. It features a buffer manager, a totally reentrant file manager and optional multiple print queuing. Price is $300 for the minimum system configuration.

MuSYS, 1451 Irvine Blvd., Suite 11, Tustin, CA 92680. Reader service number 496.

Four Atari Game Programs

Manhattan Software, PO Box 35, Pacific Palisades, CA 90272, has begun issuing a series of programs for the Atari computer. Gin Rummy 3.0, with color card graphics and sound, plays a full regulation game of Gin, and can hold its own against even skilled Gin players. Priced at $19.95, the program requires 32K and one joystick.

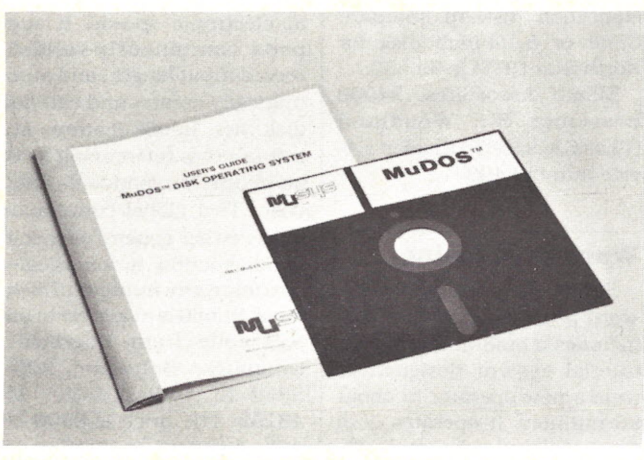
Casino Blackjack/Counter, a simulation of playing at a casino table, has card graphics to show five hands dealt, and the user plays the center hand while the computer plays the rest. The program teaches card-counting, which is claimed to give the player a statistical advantage over the house in some situations. Priced at $19.95, for 24K and one joystick.

Labyrinth Run is a test of skill and coordination, in which the player uses the joystick to guide a fast-moving runner through twists, turns, reverses and slaloms, with thunderous crashes when the runner hits a wall. Three skill levels. $14.95, for 16K memory and one joystick.

Concentration, with full-color graphic symbols, is a computer version of the classic match-the-card game. Two-person competition, in 16K or 24K. Priced at $14.95, the game requires two joysticks. Reader service number 485.

Bowling System for PET/CBM

A complete scoring system for bowling league secretaries is now available from Harry H. Briley, Box 2913, Livermore, CA 94550. The programs run on a 32K PET with disk and printer, and will handle scratch and handicap bowling leagues with up to 24 teams. A smaller version will handle 12 teams on a 16K



MuDOS from the MuSYS Corporation.

PET, using cassette data storage.

Entry of weekly scores results in a scored and handicapped printed summary. Provision is made for forfeits, blinds, partial absences, snapout errors, postponements, team ties, individual ties, subs, name changes, drops, ineligibles, messages, display of secretary's lane and lane assignments anywhere in a 98-lane house. A year-end sweeper program that runs off the final data disk is available, as is a complete archive program that will read each week's disk record for data on each bowler. This data will provide a custom summary at the end for each league member and team. Prices start at $40. Reader service number 494.

Recover Erased CP/M Files

What do you do after entering "ERA*.BAS" instead of entering "ERA*.BAK", besides cuss? Now the UNERA program can be used to recover one or more of those erased programs. Just enter "UNERA (filename)" and the UNERA program will recatalog the (filename) back on the disk directory. The UNERA program can also work its way through a disk directory and display each erased file name, allowing the user to recatalog the file if desired. Another handy feature is that the program lets the user list the program action on the printer. The UNERA program works on both multidisk and single-disk systems that use a standard CP/M disk directory. The eight-inch disk in standard CP/M or 5-1/4-inch disk for North Star CP/M is $36.50.

Elliam Associates, 24000 Bessemer St., Woodland Hills, CA 91367. Reader service number 493.

Word Processing

Select is an easy-to-use word processing system that includes a built-in interactive tutorial system designed to train a new operator in about 90 minutes. It operates with single-key mnemonics. To create a new document, type C; to delete, insert, move, copy, append or to key any of the other commands, simply enter the first letter of that command. All of Select's commands are explained on the first line of the screen. Select includes an integrated spelling dictionary, which is called up by typing S. Tell the speller the name of the document to be corrected, and Superspell compares the contents of the document with its dictionary at 10,000 words per minute. Superspell then reports how many words in the text are incorrect, and which words they are. It then takes you to the text containing the errors, so you can replace the misspelled words one at a time.

Select produces a screen image of tabs, margins, paragraph indentations and line justifications, including automatic centering and left and right margin justification. It also features word-wrap, pagination using either words or numbers, and easily-inserted, logical commands for boldface, underline, subscripts and superscripts. Select for Z-80-based microcomputers is priced at $595; the Apple version is $395.

Select Information Systems, Inc., 919 Sir Francis Drake Blvd., Kentfield, CA 94904. Reader service number 497.

Data Management

Info80 is an automatic information filing and information management system designed to run on the TRS-80 Model I and Model III. The system creates an encyclopedia of information and references which can be quickly located at electronic speeds. It supports continuously-variable record input length, and automatically creates and extends disk files. Info80 features absolute cross-referencing with an infinitely expandable database. Two global commands locate either general or specific information, automatically spanning any number of diskettes. Info80 is available in object code from Bluebird's Computer Software, 2267 23rd St., Wyandotte, MI 48192. The price is $100 on data diskette, or $115 on a TRSDOS diskette. Reader service number 466.

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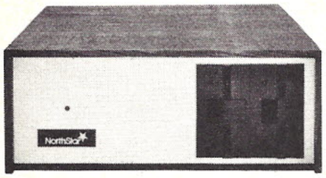

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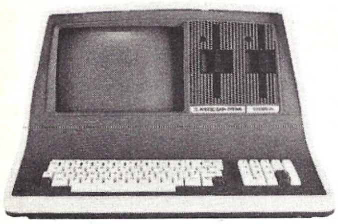

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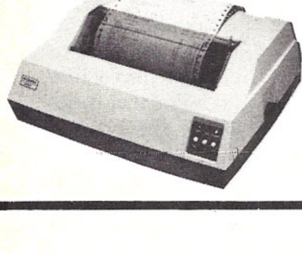

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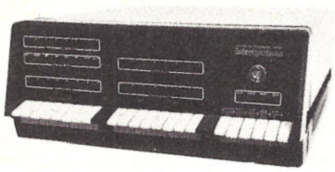

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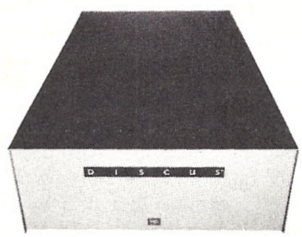

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Color Your Apple-II With This Micro Paint Set

Micro-Painter from Datasoft

Micro-Painter is a program that lets you "paint" bounded areas—any area completely bounded by a black line—on your television, using any of 21 colors.

The program, written by Bob Bishop, is for the Apple-II with 48K or an Apple-II Plus disk, 13-sector system. It includes a 5-1/4 inch floppy disk, plus a 32-page instruction manual. It is packaged in an attractive box protected by plastic shrink wrapping, and retails for $35.

To get the hang of Micro-Painter, you choose from a selection of full-screen pictures drawn in black and white. You then use Micro-Painter to change the white areas to the color of your choice.

It is indeed fascinating to watch Micro-Painter in action. In its normal mode of operation you position a cursor anywhere on the screen, using your paddles or a joystick. You select the color that you want to paint with, using the Apple keyboard. Then, you "paint" simply by pressing the button on your paddle or joystick. When this is done, the color that you selected rapidly expands (it seems like magic!) from the cursor point to fill the entire bounded area surrounding the cursor. You can then move the cursor to another bounded area and repeat the process.

Once an area has been "painted" with a color, you cannot repaint that area with a different color. (You may, however, save a master copy of a picture while it is in the black and white stage. Then, you can recall this master and paint it as many times as you want, using different colors each time.)

Micro-Painter is able to come up with 21 shades of color by blending the six basic colors that the Apple is able to generate in the high-resolution mode. Essentially the trick consists of using alternating colors in alternating pixels to produce a checkerboard arrangement that the eye perceives as a particular shade of color. For example, dark blue is produced by alternating pixels of blue and black.

Some shades are achieved by alternating the color of rows of pixels. For example, blue-violet is produced by displaying a row of pixels using the color blue alternated with a row using the color violet.

It is important to realize that the software does not give the hardware any more capability than it inherently has. When reading advertisements for the Micro-Painter it is easy to assume that the software somehow lets the computer produce more colors than the manufacturer says it is able to produce. It is really a matter of semantics in some respects. At the pixel level, the Apple-II will still only be producing six standard colors when Micro-Painter is in operation. However, at the practical level, the pixel-by-pixel blending of various combinations of the basic colors produces the 21 shades that are touted as colors by the program's promoters.

It always takes two keystrokes to specify a "painting" color. For instance, if you want to specify dark blue, you press the D key followed by the B key. (You can also accomplish this by pressing the B key and then the D key.) Since 21 shades of color may be specified, and each of these may be specified two ways, 42 keystroke combinations can be used to specify colors. Six pages in the manual present the keystrokes required to produce each shade. The large number of pages used is the result of illustrating the actual pixel interlacing patterns of the primary colors used to produce each shade.

The only real criticism I have of this package—and I mention this only as a constructive suggestion—is that it would be nice if the keystrokes required to call out the various shades of color were all summarized on a single page, or, better yet, on a small card. Such a card could be placed on the computer console, and would make initial operation of the package more convenient. Indeed, the rest of the commands associated with the use of Micro-Painter might be placed on such a card. I frankly think that people would truly appreciate the inclusion of such an item in the package a lot more than they are likely to appreciate the six crayons and the magnifying glass that are now included as gimmicks.

Micro-Painter has a special mode of operation that the producer calls "microscope world." In this mode a small portion of the normal screen is magnified so that you can view and alter parts of a drawing on a pixel-by-pixel basis. This enables the computer artist to do precise touch-ups, so to speak. All it takes to switch from the normal viewing/painting mode to the touch-up mode is a press of the space bar on the Apple's keyboard. Thus, it is easy to make a few minor changes at the pixel level, then switch back to see how it affects the overall picture in the regular viewing mode.

You can practice learning how to use Micro-Painter by painting the pictures provided on the disk that holds the program.

What do you do when you think you have had enough practice and want to create your own painted pictures? Why, you just draw your own pictures. You can do this using a graphics tablet. Or, you can draw pictures using a joystick or paddles using the BASIC program supplied in the Micro-Painter manual, if you have Applesoft BASIC on ROM in your system.

If you have a graphics tablet, chances are that your system will draw white lines upon a black background. Since Micro-Painter uses black lines as boundaries of areas to be painted, inverse and fix commands are provided as part of Micro-Painter to convert such drawings to the format required by the program.

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Nat Wadsworth
Seymour, CT

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CORRECTIONS

Michael Grady (PO Box 27575, Escondido, CA 92027), author of "Micros Say the Darn'dest Things," (April 1981, p. 92) writes to say that he omitted any means of calling up VB$ verbs (lines 440–530) in his program listing. Although the program works perfectly well as it is, to see some sentences with VB$ verbs appear on the screen, just add the following lines to the program:

```
1261 X=FN R(X)
1262 IF X=<4 THEN X=FN R(X): VP$=VB$(X):
     KY=1: GOTO 1320
1341 IF KY=1 THEN KY=0: VP$=VP$+J$(2):
     GOTO 1570
```

The "Dial-up Directory" column in the April 1981 issue (p. 16) mistakenly credits Digital Equipment Corporation as authors of the CP/M Operating System. Of course, it should have read Digital Research, Inc. (Pacific Grove, CA), who originally wrote the CP/M Operating System for the Heath H-89.

Dr. E. Stanton Maxey, author of "Tracking the Planets," March 1981, p. 130, notes that "the Gregorian conversion, for a reason not clear to me, fails by +1 days for the entire month of September 1900. Otherwise, it is accurate. Listing 1 is accurate for the entire period 1868-1981."

There is an error in the hex dump listing that affects the screen display by not printing the last two characters in "Save It with CASSY," April 1981, p. 41. Location $0F1F_{16}$ should be changed from BD to 8D. With this change, the program works fine.

Dr. Michael Bazaral ("AIM for Total Control," May 1981) informs us that the name of the president of RNB Enterprises is Raymond Bennet, not Michael G. Bennet, as was printed in his article on p. 104.

Jaime Eyzaguirre, a regular follower of the Micro Quiz column, was quick to point out that May's quiz answer contained an error. X(i) should read A(i) on page 243.

```
10 'The Gregorian conversion as published
20 'in Kilobaud March 1981 pp 133
30 'lines 2830 through 2870 fails
40 'for September 1900.
50 'The following has been thoroughly
60 'checked and is accurate.
2830 IJD=367*IY
2840 IJD=IJD-7*(IY+(IM+9)\12)\4
2850 IJD=IJD-3*((IY+(IM-9)\7)\100+1)\4
2860 IJD=IJD+(275*IM\9)+ID+1721029#
2870 IJD=IJD-.5#'half day diff in standard
```

Listing 1.

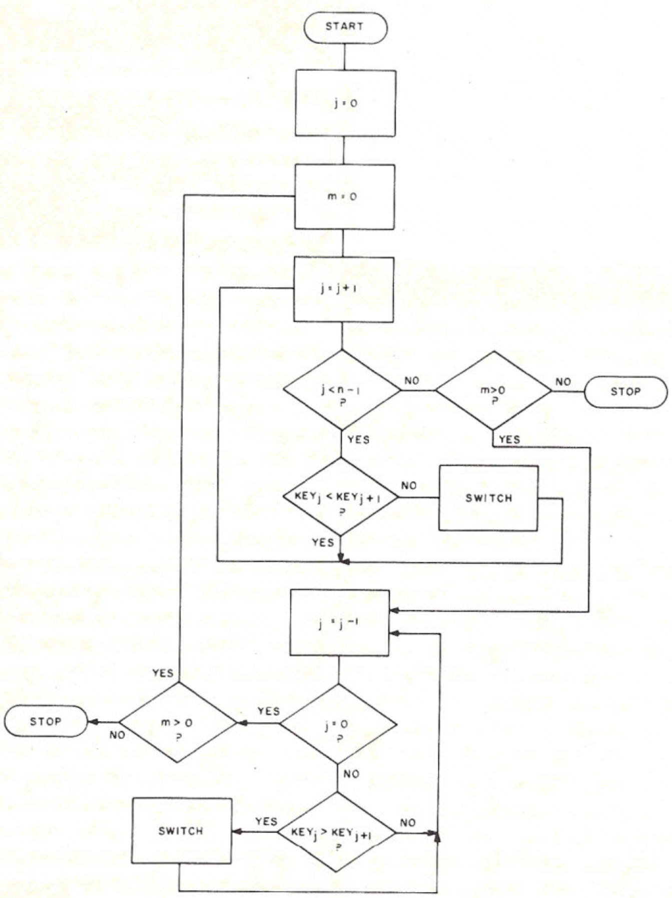


Fig. 1. Two-way bubble sort.

Several of our readers have written in to point out that the captions identifying the two flowcharts (pp. 148 and 149, April 1981, "A Better Bubble Sort") have been switched. Also, the two-way bubble sort flowchart has a line missing at the bottom of the flowchart in the published diagram. It is correct as shown in Fig. 1.

Coauthor Warren A. Harrison states that, concerning the "efficiency" of the bubble sort: "Quicker sorts than the bubble sort and its cousins are available, but the difference is negligible for small lists. Because we usually sort a larger group of data than just a key (e.g., a record), most micros have difficulty in accommodating a larger list than 40 or 50 elements.

"As an example, consider an 80-byte record. Fifty of these would require over 4000 bytes of memory when you include the bookkeeping required to build an array or matrix. Therefore, most sorting tasks with over 50 elements use external sorts such as the good ol' merge sort or radix sort, or one of their cousins, and an external storage device such as tape or disk. This is common practice with even the big machines which may have 'unlimited in-core storage' via virtual memory. Many extremely efficient external sorts exist. However, for the size of the list which we would normally use an internal sort on, the slowness of the bubble sort is not that much of a problem."

Basic Business Software
H-8 Programming for Beginners
Build Your Own Micro

Basic Business Software

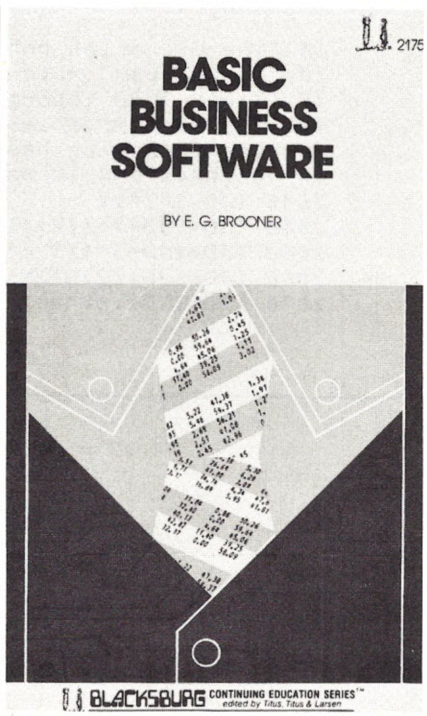
E. G. Brooner
Howard W. Sams & Co., Inc., 1980
Softcover, 142 pp., $9.95

The rapid development of the electronics industry has created a paradox in the computer market—we have the hardware, but lack the software to use the equipment to its potential. The business field is probably the most affected industry of all, since the user usually has a small mathematical background with little or no knowledge of computer science, relying mainly on off-the-shelf software. *Basic Business Software* is an excellent guide for the business person who finds himself or herself in this situation.

Ernest Brooner, the president of a computer consultation firm in Kalispell, MT, has written this book for the business person who is considering changing to a computer system, or a person who already has, and who has a basic understanding of computers. He deals with the problems of obtaining satisfactory software and equipment that will allow the user to expand as his business increases. *Basic Business Software* will be most useful when used in conjunction with the North Star Horizon and with computers using Microsoft BASIC.

Chapters 1–4 deal with the purchase of the actual computer and peripheral equipment necessary to make the system practical. As Brooner states, "Although a video terminal is sufficient for hobby uses, a serious business must have a 'hard copy,' as computer persons usually refer to anything printed on paper. And while the hobbyist could fuss with the eccentricities of cassette tape, the disk was the only medium of storage both reliable enough and cheap enough for . . . small businesses," thus making a printer and disk system integral parts of a functional business system.

Brooner also says that software should not be purchased unless the user has seen the program in actual use. Software, as Brooner points out, is the most difficult component of a computer to select.



Chapter 4 deals primarily with one of the most essential parts of operation of a computer—customizing purchased software and writing individual programs. To a partially skilled programmer, writing programs designed especially for his needs may be much easier and cheaper than customizing standard software. This is done if, and only if, the programmer takes an organized approach to solving the problem, and knows the abilities of his machine. Business programs as a rule do not require complex mathematics, only basic operations. However, the programmer must have adequate knowledge of sorting techniques and should design the program in a logical manner.

Chapter 5 develops the concepts introduced in the latter chapter through a program, Namelist, which sorts names and addresses in alphabetical order through shell sorting, a technique that arranges data in a certain order as the data is being printed, rather than in storage.

Chapters 6–8 provide several programs involving payrolls, inventories and general ledgers. The text instructs the reader on developing specialized programs of the same type, providing necessary information and possible bugs. The last two chapters introduce computer modeling and the currently hot item, word processing.

Whether a person is considering converting to computers, has just purchased a system and wishes to increase its capacity, or is just interested in computers, *Basic Business Software* by E. G. Brooner is a valuable tool.

Paul D. Tyler
Salt Lake City, UT

H-8 Programming for Beginners

Ron Santore, Don Inman and Bob Albrecht
dilithium Press, 1980
$8.95, paperback

Owners of fully-equipped H8 systems may be astonished to learn that a barebones H8 can be educational and fun. The *Heath Operation Manual* does little to encourage this view although assemblers of the kit will recall the thrill of seeing the initial test message displayed on the LED array, the result of entering a program through the front panel keyboard. This was followed by a memory test routine, another machine-language program. About here you may have been overcome by an urge to understand how these programs work. Here is a book that will help satisfy that curiosity.

This book, written by three experienced microcomputer educators, is a short course in machine-language programming, designed specifically for the H8 computer. As the title suggests, it assumes that the reader has no previous knowledge of programming. It does assume that he has an H8 computer with 4K of memory. No terminal, cassette or disk system is required.

Everything is explained in easily un-

derstood language from bits and bytes in chapter one, through addressing, the PAM-8 monitor and progressing through

```
040.307  041 356 003  LXI H, DODA
040.312  205          ADD L
040.313  157          MOV L,A
040.314  176          MOV A,M
040.315  366 200      ORI 200Q
040.317  062 023 040  STA 040.023
040.322  311          RET
```

Correction to subroutine 1 of Dice program.

```
040.337  041 356 003  LXI H, DODA
040.342  205          ADD L
040.343  157          MOV L,A
040.344  176          MOV A,M
040.345  366 200      ORI 200Q
040.347  062 022 040  STA 040.022
040.352  311          RET
```

Correction to subroutine 2 of Dice program.

```
040.103  117          MOV C,A
040.104  315 260 003  CALL INPUT SUBROUTINE
040.107  271          CMP C
040.110  372 150 040  JM
040.113  302 165 040  JNZ

040.162  303 104 040  JMP
040.177  303 104 040  JMP

040.120  076 100      MVI A,100Q
040.122  315 140 002  CALL BEEP
040.125  076 100      MVI A,100Q
040.127  315 053 000  CALL DELAY
040.132  025          DCR D
040.133  302 120 040  JNZ
040.136  303 100 040  JMP

041.013  346 007      ANI,007
041.015  311          RET
```

Changes to HiLo. Remove time delays from output subroutines 1 and 2 by inserting 311 (RET) at 040.312 and 040.342.

the 8080 op code list, with a heavy sprinkling of exercises, questions and simple programming assignments. The appendix includes 21 pages of answers to questions that appear throughout the text. Other items include 8080 op code definitions, an op code reference table, a brief description of the hexadecimal number system and an ASCII code table.

Game programs are used through the entire book to illustrate programming instructions and techniques. Program complexity increases as new op codes are introduced and culminate in Dice, HiLo and Stars. These final games are, of course, quite primitive, but they do serve as an example of what can be done without a video terminal, printer or any kind of mass storage.

It is, perhaps, unfortunate that programming deficiencies appear in Dice and HiLo. But the beginning programmer can get some real-world experience by figuring out what has to be changed in these two programs to make them run as intended. It is this debugging process that best teaches the important details of programming. (See Listings.)

The descriptive paragraph about the book, appearing on the back cover, indicates that "it not only covers assembly-language programming but also Benton Harbor BASIC." Strictly speaking, assembly-language programming requires the use of an assembler program. Doing it by hand is really machine-language programming, which this book covers effectively. BASIC is not covered, or even mentioned. A minimum H8 system can't handle BASIC.

Chesney Twombly
Kennebunk, ME

TRS-80 Interfacing, Book 2

Jonathan A. Titus, Christopher A. Titus and David G. Larsen
Blacksburg Continuing Education Series
Indianapolis, Howard W. Sams & Co., Inc., 1980
$10.95

Because of the computer's popularity, users of the TRS-80 are faced with an undifferentiated and overheralded output of publishing, much of it by novices and most of it priced at $20 or more. The Blacksburg series has been a continuing and notable exception, with more than two dozen titles covering digital logic, analog circuitry and microcomputer hardware and software.

TRS-80 Interfacing, Book 2, continues in that tradition: down to business, full of facts and written with concerted clarity. Each chapter begins with its objectives—what will be discussed, described, designed and built—and, if the reader is attentive, succeeds in every one.

Book 1 of the series presented the basic concepts of interfacing, a description of the Z-80 processor, breadboarding, software controls and a group of experiments (see the review by Ed Neister, *80 Microcomputing*, September 1980, p. 20). *Book 2* is more intense. It describes open-collector devices, peripheral drivers and transistor arrays and shows complete pin-out diagrams, data and sample applications. Chapter 1 concludes with a discussion of interfacing to house current (and some of the circuit protection necessary), and a list of manufacturers.

The second chapter is the book's star. It deals with the process of real-world, real-time interfacing: analog-to-digital and digital-to-analog conversions and their use. D/A integrated circuits are described, interfaced to the TRS-80 and run through BASIC software. Accuracy is discussed in terms of both the number of bits used in the conversion, and the stability of the power supply and reference voltage. In an interesting turnabout, an interface is shown that uses its own references and accuracy to control a programmable power supply for another piece of equipment!

An interface, plus BASIC and assembly-language software to drive it, is described to run an X-Y graphic plotter. Linear and sine-function programming is demonstrated.

The chapter continues with analog-to-digital conversion; this process, which is more complicated than its converse, is detailed. Eight- and 12-bit converters are put to work measuring temperature and light intensity, along with an exhaustive rundown of the software considerations, including the potential for errors and their solutions. The chapter lists converter manufacturers.

Chapter 3 gives the interfacing process its important perspective, including how the data is sampled, scaled, averaged, filtered and otherwise manipulated to produce accurate and usable results. Readers must grit their teeth and plunge into the mathematics in this chapter, because the authors make clear that responsible results cannot be achieved without correct handling of the raw data produced with the interfacing they have described.

The authors turn from real-world interfacing to machine interfacing. Chapter 4 is a very substantial description of communication and remote control with the computer using parallel-to-serial and serial-to-parallel conversion. Synchronous, asynchronous and addressable receiver/transmitter chips are described, data and pin-outs are presented, along with working circuits and software.

The authors describe the formats, or protocols, of data transmission, including baud rates; start, data and stop bits; and conversions of data in various forms to ASCII. Significantly, the control of D/A and A/D converters in remote locations is demonstrated. The chapter concludes with BASIC and assembly-language software to operate transmission chips.

The main text of the book concludes

with a chapter on TRS-80 interrupts. As users of the computer know, the Z-80 has three powerful interrupt modes; they are often disappointed to discover that the designers of the TRS-80 only permitted one such mode (probably the weakest of the three) to be used. Chapter 5 talks about this problem, presents simple mode 1 interrupt examples, and concludes with some hard-wired modifications to the TRS-80 that allow the use of the remaining interrupt modes.

References are given with each chapter, but the extensive appendices presented in *Book 1* are not repeated; only an ASCII chart and a single data sheet are presented here.

In summary, *TRS-80 Interface, Book 2,* is not only an important extension of *Book 1* of its own series, but an expert application manual for home, industrial and laboratory use.

Dennis Bathory Kitsz
Roxbury, VT

Mostly BASIC: Applications for Your PET

Howard Berenbon
Howard W. Sams & Co., 1980
Softcover, $10.95

Twenty-eight chapters, each containing at least one program written specifically for the PET. Real-time programs such as a telephone dialer and a digital stopwatch. Educational programs including foreign-language flash cards. Business programs such as depreciation and amortization schedules. Home utilities like a recipe calculator and a message-taker. Microcomputer hex-to-decimal conversion. A tarot card reader program. Quite an impressive package for $10.95! Is this *the* book for PET owners to have, especially with so few program books available for the PET?

Any collection of programs, especially one written for a specific system, needs to be evaluated from two points of view: the usefulness of the programs and the quality of the programming. Such a book, to be worthwhile, should be valuable to a nonprogrammer. The directions for program entry and operation should be clear and unequivocal. The programs should run on the system without needing any modification, and they should do what they are supposed to do.

Second, a person who has some understanding of the system should be able to learn programming technique by studying the listings in the book. One expects that the author writes efficient programs and uses good programming technique. He should have some interesting wrinkles in the programs from which a reader can learn. The programs should be better than an average reader could write.

Unfortunately, I cannot say that this book scores well either in the usefulness of the programs or the elegance of the programming. Some of the programs in the first section, for example, require an interface through the PET user port. A schematic and parts list are given, but nothing is said about how to construct the interface and very little about how to connect it to the user port. It would require more knowledge than a PET beginner would possess to get these programs running.

The text and instructions with each program are generally clear, but there are some glaring faults. One program's description tells the reader to press control-C to stop the run, and the PET does not have a control key!

Not all the programs do what they are supposed to do. The Digital Stopwatch program does not keep accurate time—it loses 14 seconds per minute. Many of the applications programs are trivial. They perform functions one could perform faster by hand than on a computer.

The programming style is not a good model from which to learn. Two examples: in many programs the author uses a series of lines such as:

```
100 INPUT A
110 IF A=1 THEN 560
120 IF A=2 THEN 600
130 IF A=3 THEN 640
140 IF A=4 THEN 655
```

instead of the much simpler one-liner: 100 INPUT A: ON A GOTO 560,600,640, 655. Likewise, none of the INPUTs are bulletproofed in any of the programs, a necessity when writing for inexperienced PET users!

Several programs use the RND (random) function. The author has chosen to use RND(0) for the seed, instead of the much more truly random sequence generated by RND(-TI).

These quirks and others, including the fact that no attention has been paid to making sure that the PRINT statements come out right on the screen, lead me to conclude that these programs were not, in fact, developed on a PET. It appears to me that they were written on some other computer—perhaps a large mainframe—and checked to see that they conformed to Microsoft BASIC syntax. I do not have the impression that they were actually checked out on a PET. If they had been, the obvious problems would have been evident and easily corrected before publication.

I do not wish to leave the impression that this book would not be useful to anyone. It only costs as much as one good program on tape, and any person may find a program in it which fills a specific need. If a PET owner knows enough about programming to read a listing and be sure it will do the job, he ought to look at the listings in this book. If he can get two programs out of it, it is a bargain. But I could not recommend this book to a person with no PET programming experience.

Brian S. Klinger
Rye, NH

How To Build Your Own Working Microcomputer

Charles K. Adams
Tab Books, 1980
Softbound, $9.95

On the cover of this book is the statement, "A step-by-step, start-to-finish guide to putting together a complete, working microcomputing system!"

My evaluation after reading and studying the book is, "Don't buy this book."

The author takes an 8080 chip set, LEDs and switches and creates a working computer that resembles very closely an Altair or an Imsai computer. Starting with a now-obsolete CPU for a machine base is not the most logical way to construct a computer from scratch. Unless you happen to have an 8080 chip set on hand, with irresistible urge to do something with your chips, don't bother.

A very similar approach to these same problems was taken by Dr. Norm Thagard in two articles published in *Microcomputing* ("Home-Brew Z-80 System," June and July, 1978, p. 26 and 80). However, his design uses the Z-80 as the machine base instead of the 8080. The article is much shorter, better-written and to the point. If you need to learn the 8080 code for some reason, building Norm's Z-80 design is more logical. And at least the Z-80 is still in current production.

In all fairness to author Adams, this presents a problem to every author. He writes a book that may be obsolete before he can get his work into print. This field of microcomputers is moving with a pace that is almost unbelievable. The minimum delay in getting anything published in magazines is about four months, and in book form is even longer. In four to six months anything done now could become obsolete in that time.

I got turned off in the introduction. When you give a book to a teacher to evaluate, please don't leave the verb out of a sentence. This seldom bothers normal reading techniques, but when a teacher has to reread a sentence several times to try to make the sentence convey intelligence, and has to invent the verb for that sentence, you create a framework that makes it very difficult to see how you will teach newcomers to build something as complex as a computer.

Again, in all fairness to author Adams, these errors may be attributed to the production staff, and may not be the author's fault. But as any of us know who have had work published, the printed error is the responsibility of the author, without regard to the actual source that created the error. If you intend to teach newcomers how to build a computer via the printed page, then the errors (all of them) had better be insignificant, and they had better be few.

There are many errors in the book. Some are insignificant, but some are so severe that author Adams can expect many, many letters from builders requesting help. I had two 5 × 8 cards filled with errors that would need explaining to one of my students if he or she were to build this computer using this book. I still had not reached the end of the first phase of the design of the machine, so I quit taking notes on errors that I might have to answer. None of my students were going to build this design if I could talk them out of it.

At the time this book arrived for my evaluation, I was working on a Z-80 design, and since I have no software experience at all with the Z-80 or the 8080, I did use many of the programs that author Adams gives in the book to build some software experience. I am pleased to report that all of the software I tried worked fine.

So unless you have an 8080 chip set that "must be put into operation," and you are far, far beyond the novice or beginner's stage with your hardware (or you have an electronics instructor immediately available to answer all your questions) or you are willing to write author Adams several times to get his help in building his design, use your $10 to better advantage.

George Young
Sierra High School
Tollhouse, CA

✓See List of Advertisers on page 194

CALENDAR

Personal Computer Show

The 4th Personal Computer World Show will be held at the Cunard Hotel, Hammersmith, London, from Sept. 10–12. Further information can be obtained by writing Timothy Collins, Personal Computer World Show, 11 Manchester Square, London W1E 2QZ.

IEEE Computer Society Conference

"Productivity—An Urgent Priority" is the theme of the IEEE Computer Society Compcon Fall '81 to be held Sept. 14–17 at the Capital Hilton Hotel, Washington, DC. Contact Compcon Fall '81, PO Box 639, Silver Spring, MD 20901, 301-589-3386.

/usr/ Group

The Unix commercial association /usr/ group will meet July 9–10 at the Los Angeles Marriott Hotel to discuss the needs of users and vendors of systems which use Unix operating systems and the C programming language. The two-day meeting will feature speakers, break-out group sessions and committee discussions. For more information, write /usr/ group, PO Box 8570, Stanford, CA 94305.

Computer Summer Camp

This summer youngsters can again sign up for an overnight camp in Moodus, CT, where the main activity will be computers. This unique recreational and educational experience is directed by Dr. Michael Zabinski, Professor at Fairfield University.

The 1981 National Computer Camp will feature two one-week sessions: July 19–24 and July 26–31. The campers, ages 10–17, will have small group instruction and hands-on experience.

For information, contact Michael Zabinski at 203-795-9069, or write to Computer Camp, Grand View Lodge, Box 22, Moodus, CT 06469.

London Micro Show

The 1981 Microcomputer Show will be held July 29–31, 1981, at the Wembley Conference Centre, London, England. A conference program running concurrently with the exhibition will highlight micro applications in business, production and education. Proposed topics for conference sessions include hardware availability, software packages and development, automatic test equipment, robotics and process control.

The 1981 Microcomputer Show is organized by Online Conferences, also the organizers of Viewdata 80, the first world conference on viewdata, videotext and teletext.

Potential exhibitors should contact Jeff Wolf at 800-227-3477; in Canada and California, call 415-474-3000 or write TMAC, 680 Beach St., Suite 428, San Francisco, CA 94109.

Los Angeles Shows

The Business and Personal Computer Sales Expo and the Los Angeles Business Show will be held at the Los Angeles Convention Center from July 9–11. For further information, contact Produx 2000, Inc., Box 2000, Bala Cynwyd, PA 19004.

Microcomputers for Managers

Exhibits and seminars to assist managers in the selection and use of microcomputers will be held in Denver, CO, on July 22–23. For further information, contact International Seminars, Inc., PO Box 7029, University Station, Provo, UT 84602, 801-375-7379.

Summer Computer Camp

Computer Camp East is recruiting instructors to teach programming (APL, BASIC, LOGO, Pascal) and to supervise the use of microcomputers (Apple II, PET, Atari 800, TI 99/4) for coed campers (ages 10–17). The four two-week sessions run from June 29 to July 10, July 13 to July 24, July 27 to August 7 and August 10 to August 21 at the following sites: East Haddam, CT (residential camp), West Hartford, CT (day camp), Hyannis, MA (day camp), Boston, MA (day camp), and Amherst, MA (day camp). Send resume to Professor Howard A. Peelle, Director, Instructional Applications of Computers, School of Education, University of Massachusetts, Amherst, MA 01002.

Computer Arts Festival

The Personal Computer Arts Festival, held in conjunction with the Personal Computing '81 Show at the Philadelphia Civic Center, August 28–30, will feature technical sessions, demonstrations and exhibits, as well as the annual computer music concert and computer graphics film/video show. Computer musicians and artists who would like to speak, exhibit or perform at the festival should contact PCAF '81, Box 1954, Philadelphia, PA 19105.

National Computer Shows

The National Computer Shows has announced its fall schedule of trade and public expositions for manufacturers, OEMs, distributors, dealers and retailers selling small, medium and large computers for business, industry, government and education. The shows feature office systems, data and word processing equipment, telecommunications equipment, electronic typewriters, computers for scientific and engineering applications, microcomputers, computer graphics, computer peripherals, accessories, supplies and software. The shows are: the Second Annual Midwest Computer Show, Sept. 10–13, at Chicago's McCormick Place; the Second Annual Mid-Atlantic Computer Show, Sept. 24–27, at Washington's DC Armory; the Third Annual Northeast Computer Show, Oct. 15–18, at Boston's Hynes Auditorium; and the Southeast Computer Show, Oct. 29–Nov. 1, at the Atlanta Civic Center. Contact the National Computer Shows, 824 Boylston St., Chestnut Hill, MA 02167, 617-739-2000.

Software Info '81

Software Info '81, the National Software Package Conference and Exposition, will be held Sept. 14–17 at Chicago's Merchandise Mart Expocenter. Software product exhibits, seminars and speeches are slated. For more information, contact Software Info, 1730 N. Lynn St., Suite 400, Arlington, VA 22209, 703-521-6209.

Please have calendar announcements in our hands at least two months before the issue in which they are to appear (i.e., by May 1 for the July issue, which comes out at the end of June). Send them to the attention of the Managing Editor (Kilobaud Microcomputing, 80 Pine St., Peterborough, NH 03458).

PERSPECTIVES

(from page 226)

you will be because your best talents are being used.

After you've completed your self-analysis and understand where your greatest strengths lie, it is time to look for the job that will utilize them. If your analysis shows that you enjoy dealing with people and are receptive to individuals' stated needs and can be persuasive, perhaps a sales position is for you. If you find you are creative, enjoy tinkering and like teaching children, you may find your services are desperately needed by electronic toy makers. If you are a stickler for detail, have artistic abilities and have the patience of Job, you may be a natural for masked ROM code layout and integrated circuit design.

When you have a good idea what you have to offer an employer, look at ads in technical magazines and newspapers like *Electronic Design*, *Computer Decisions* and *Electronic News*. You'll be amazed at the number of ads aimed directly at microcomputer personnel these days. Unless you're now a major banking executive or the like, I'll bet you'll be surprised at the salaries listed, too.

Some of the positions listed will require college degrees. Don't let this intimidate you if you don't have one. Some companies will consider certain types of experience just as valuable. Many have entry-level positions where experience can be built. Furthermore, you might be amazed at the similarities between artistic floor tile design and computer schematic design. So whatever your past experience, there is probably a field where it is applicable. Again, it's up to you to decide where your particular talents lie.

Before you rush right off and apply for a job, do some study first. Read a book or two that pertains to your area. If you want to be a Z-80 programmer, knowing about a few different authors' approaches to floating point arithmetic would be very impressive to an employer. Study to get there. A microcomputer course taken at a local college could really be a plus in your favor (even if you already have a degree). Don't forget to go over past issues of *Kilobaud Microcomputing* for choice tidbits in your field.

Before you rush right off and apply for a job, do some study first.

Become an active member in your local computer club. Give a presentation about any areas you may feel comfortable with. Others will learn and appreciate it. You certainly will expand your knowledge that way.

The Search Begins

Once you are properly prepared through analysis and study, it is time to find that big job. Although the want ads can give you ideas of generally what's available and who's looking, by the time it hits print, the position has already been offered to hundreds of people. Companies would rather find people internal to their organization or through referrals than go to the expense of open advertising. In his book, *Guerilla Tactics in the Job Market*, Tom Jackson observes that on any given day, 85 percent of all jobs available are not advertised. I highly recommend that any serious job hunter read this book.

A better approach than passively watching the papers and technical magazines is to actively look for a position. Al-

✓See List of Advertisers on page 194

though you may not realize it, if you have completed the self-analysis and study phases, you are in better shape than about 90 percent of the job hunters on the market today. Not only do you know what your best talents are, but you have also decided how they can best be used. Employers are quick to recognize an individual who knows his talents. Such a person not only knows what he wants for himself, but what he can offer an employer. This type of person is much rarer than you may think.

Although answering an ad in today's paper may turn up the perfect job, look in last year's paper and see who was hiring in your chosen field. Do some research on that company's work. Call their field service representatives or branch offices. Feel out these contacts for leads toward the type of position you want.

Call the head of the department you think you'd like to work for. Tell him you're interested in his line of work and would like an opportunity to discuss this new field and its future with him. Rather than asking him for a job interview for you, ask to interview him as an expert in his field. After getting his opinion of that line of work, describe how you feel particularly suited to work in the field and ask what you need to do to get started. Ask if he knows anyone who would be interested in hiring you.

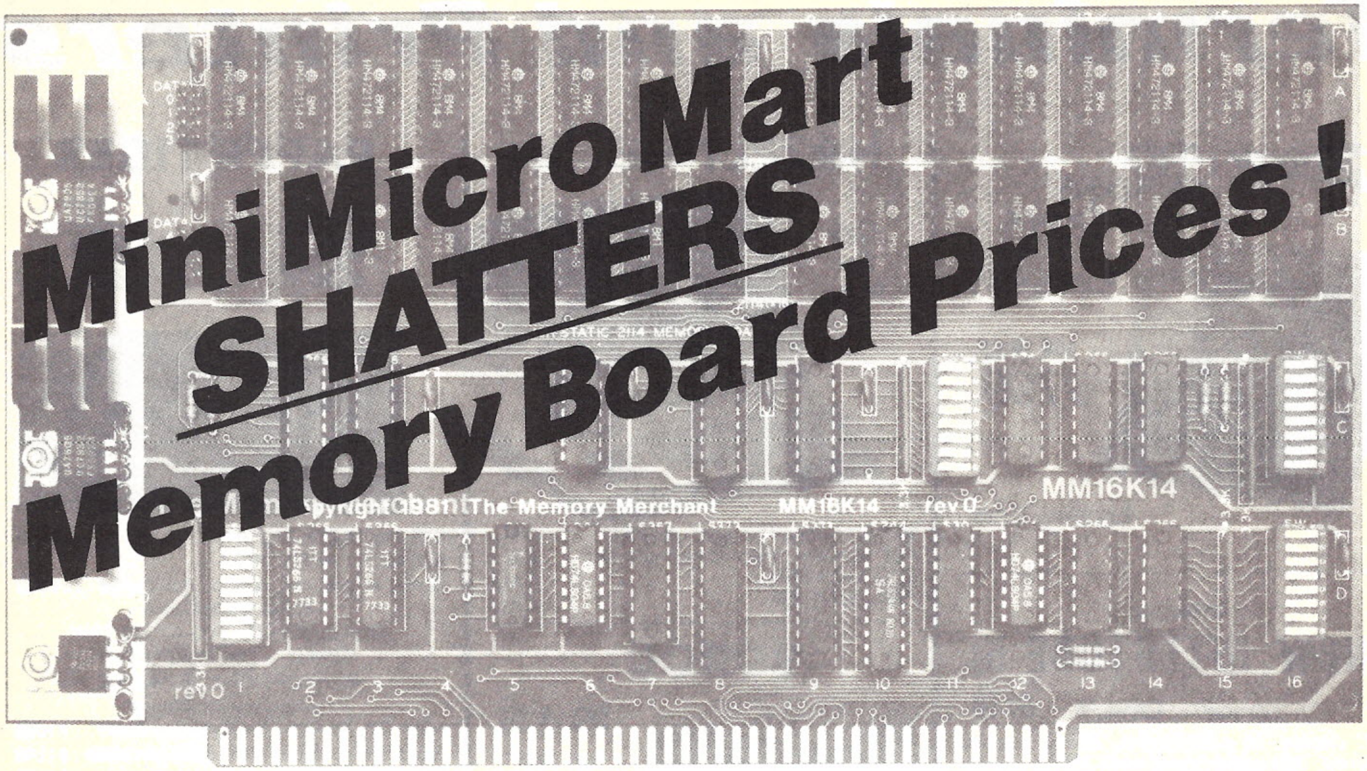
When inquiring about jobs you will almost always be asked for a resume. Have one ready at all times. Avoid personnel departments as much as possible and deal directly with line managers. These are the people who really understand the positions available and have the final say in hiring. I have often thought personnel departments—bless their corporate souls—to be the curse of modern technology. The people who run them are not technically oriented and will assume a round peg (you) is looking for a square hole (their company).

Avoid personnel departments and deal directly with line managers.

Placement agencies may be of some interest or use to you, but only if they are fee paid. There is enough demand for microcomputer professionals that companies will pay agency fees. Do not mess with one that tries to dip into your pockets. Generally, I have found agencies to be run by the same type of people that man personnel offices. There is a sad lack of understanding of the growing microcomputer field openings among most personnel agencies. Again, this stems from nontechnically oriented people trying to match capabilities of one name with the needs of another, the sum total of which is meaningless (except for revenue) to them. If you have technical understanding and want to open a personnel agency, I would be interested in sharing some ideas with you.

If you are asked in for an interview with a company, be sure to dress carefully and professionally. While your dress cannot guarantee getting the position you want, improper dress may well guarantee not being able to.

The professional hiring process has nothing to do with favors. There is no need to be nervous. If a company takes the time to ask you in for an interview, it is because they believe you may be of value to them. They hope to profit from the job you can do. If you have done your self-analysis and study, you'll be way ahead of the game and can tell them why you know you can do the job, and even point to achievements from your past that prove it.□



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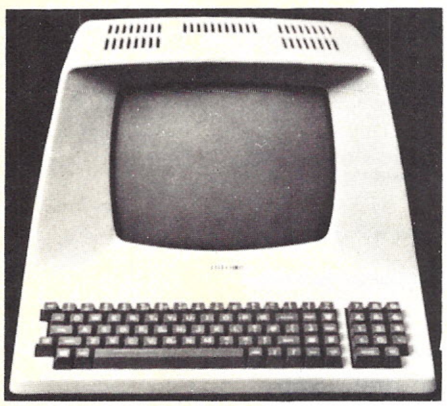

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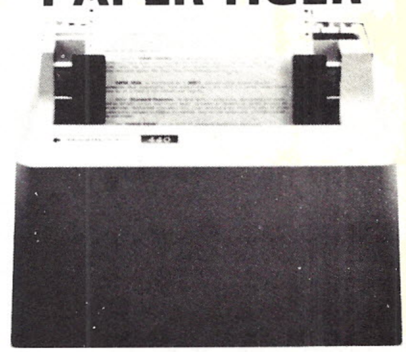

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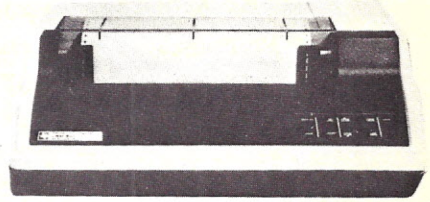

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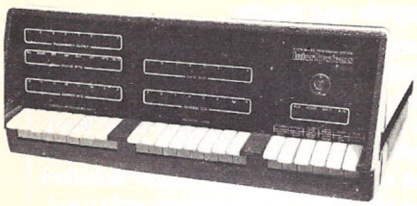

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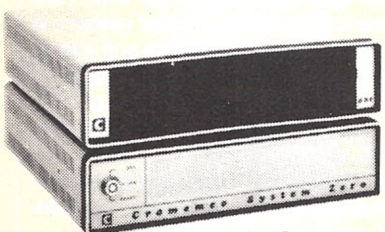

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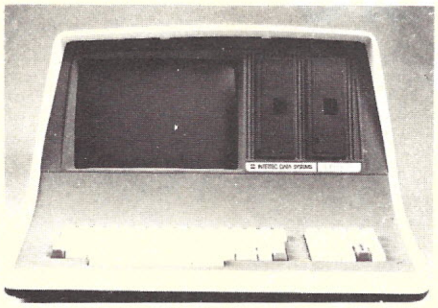

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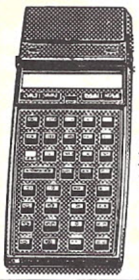

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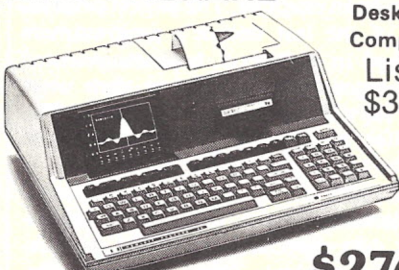

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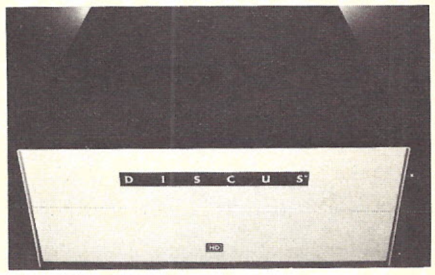

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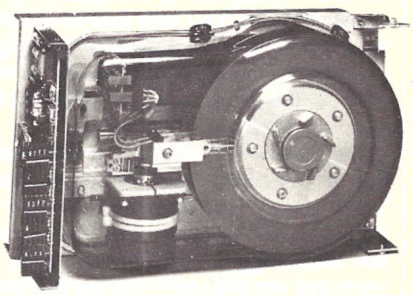

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By R. M. Dumse

Is Your Future In Micros?

Career Opportunities Abound

Is your hobby time more productive than your time at work? Does it offer more personal satisfaction? Do you look forward to your hobby while on the job?

If you spend more than two hours a week playing with, reading about, programming or otherwise being involved in your microcomputer, odds are you are suffering from hidden talent. Furthermore, if you find those hours more satisfying than the 40 or so you spend on your life's work, it may be time for a career change. Exciting, new professional positions are immediately available. The decision is yours. You may find your future in microcomputers. Realizing this helped me enter the most satisfying job I've ever had. At the same time, I've doubled my salary in less than three years.

Even without knowing it, nearly everyone is now affected by microprocessors. The digital wristwatch, the electronic TV game, the timer on the microwave oven, the traffic lights and a host of other devices you see and use every day are based on microprocessors. And we've only just begun!

If you are one of the individuals who has taken the time to buy a microcomputer, you've participated in a billion dollar business that didn't exist five years ago. That kind of growth can mean only one thing—thousands and thousands of new jobs.

These positions are available in vastly different areas, too. Hardware design and programming are two large areas, but there are endless possibilities. Applications, testing, product evaluation, sales, marketing analysis, project leaders, management and store operator positions are just a few. Many of the engineering jobs are found in California and the sun belt, but are not restricted to that region by any means. Sales positions are everywhere, and as the momentum of the microcomputer revolution continues to increase, other openings will spring up.

Employed or Self-Employed?

Because there are several excellent idea and "how-to" books on working for yourself (i.e., Don Lancaster's *The Incredible Secret Money Machine* and Joe Weisbecker's *Home Computers Can Make You Rich*), it is not my intention to cover the area of self-employment. This certainly does not mean it is not desirable or profitable. It certainly can be, and I know individuals who are becoming rich doing it. Before you decide to go into business for yourself though, look up your local computer store operator. Buy him a cup of coffee, and he'll probably be delighted to sober you with his problems.

An important question you may ask yourself is, "Who are the people filling these new jobs?" If your first reaction is those with years of experience, think again. Professionals with over four years' experience in microprocessors are as scarce as hens' teeth. Remember, micros did not exist until the mid-seventies. It takes time for new professionals to join the ranks.

Surprisingly, most of the "pre-micro" computer specialists are ill-prepared to jump into a micromarket. Take programmers as an example. The largest percentage of the last decade's programmers worked in high-level, business-oriented languages. Many are set in their ways and have no intentions of changing. The greatest applications of micros will not be in the business field, but in the scientific area. Software will be needed for special applications, voice generators, simulators, data collection, real-world monitoring and control. These are, typically, written in low-level codes such as assembler, machine and scientific languages. (BASIC, FORTH and C, for example.)

Many of the applications involving real-time processing are interrupt-driven and require input/output procedures. They may also require a minimal understanding of hardware. Any hobbyist who has ever successfully interfaced his micro to a printer or display, has added a real-time clock or written animated software for his micro, has an immense advantage and understanding over a more "conventionally experienced" programmer.

Analysis and Study

Since there are so many types of jobs available, your first step will be deciding which ones appeal to you. A very important part of this will come from soul-searching. You must identify your unique set of talents. You will only be satisfied when your best talents are properly used.

I highly recommend the self-analysis outlined by Bernard Haldane in his book, *How to Make a Habit of Success.* You should list the major accomplishments of your life on a sheet of paper. They may or may not have anything to do with your life's work; the only thing that matters is that they give you satisfaction and a good feeling. Then list the key qualities in each item; for example, resourcefulness, creativity, problem solving, management, etc. You should quickly begin to see a pattern developing. These key factors repeated over and over again are your hidden talents demanding expression.

This analysis is very important in deciding your future. It works because while everyone has thousands of experiences each day, some stand out as being milestones in our lives. Even though two people may do the same thing the same way, one will mark the event in his mind as a crowning achievement, while the other simply remembers it (if at all) as only an ordinary happening. You remember your greatest accomplishments because they have meaning to you. Your memory is trying to tell you something; that is, this is the kind of thing that will make you happy. The more you do it, the happier

(continued on page 221)

R. M. Dumse (4781 Sanbert, Placentia, CA 92670) is an applications engineer and R6500 series designer course instructor at Rockwell International. He represents their line of four-, eight- and 16-bit processors and support devices at trade shows and customer interviews.